Father's role in infancy: Examining the influence of paternal depression in the postnatal period on early father-infant interactions

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To granny, mum and dad

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Abstract

Background: Parental depression in the post-natal period is associated with an increased risk of adverse child outcomes. Research has consistently revealed impaired interactions of postnatally depressed mothers, and this is one pathway by which children are affected. Evidence suggests that depression can also affect fathers in the postnatal period and this influences children's development; yet we are only beginning to understand the factors that explain this intergenerational transmission. This thesis aims to examine: (i) the influence of paternal depression on father-infant interactions at three months and (ii) the potential mediating role of these early interactions in the development of later child externalizing problems.

Method: In a longitudinal investigation, 118 fathers were assessed for depressive symptoms postnatally using a structured clinical interview. Observational behaviours of fathers and their infants were coded using the Global Rating Scale (GRS). Two exploratory studies were conducted on a sub-sample of depressed and non-depressed fathers, matched on age and education (n=38). In the first study, behaviours representing the paternal repertoire were measured and in the second, paternal speech was analysed. New scales were developed for both these studies. Child Externalizing behaviours at one year were measured using maternal ratings on the Child Behaviour Checklist (CBCL/1½-5).

Results: Depressed fathers were more withdrawn in their interactions with their infants and more negative in their speech compared to controls. They engaged in less gentle touch, fewer episodes of excitatory arousal and less active engagement. Decreased engagement mediated the association between paternal depression and child behaviour problems.

Conclusion: This study has identified aspects of father-infant interaction that are impaired by depression. These parenting behaviours may be a potential target of intervention in postnatally depressed fathers.

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Chapter 1: An introduction to the thesis

1.1 Background

Depression is ranked the second most disabling disorder after heart disease by the World Health Organisation (WHO); in an evaluation of disability- adjusted life years (DALYs) associated with major illnesses (C. J. Murray & Lopez, 1997). The lifetime prevalence of depression in the general population is 16.2% (Kessler et al., 2003) and it is the most widely researched type of parental pathology as a source of risk for adverse child outcomes (Downey & Coyne, 1990). According to the Diagnostic and Statistical Manual of Mental Disorders (DMS-IV), the diagnostic criterion for major depressive disorder includes a depressed mood or loss of interest or pleasure in daily activities; consistently for at least a two week period. This mood represents a change in the individual's normal mood; characterised by impairment in social, occupational and educational functioning, preoccupation with worthlessness, suicidal ideation and psychomotor retardation. The DSM IV uses two diagnostic criteria for depression: (i) depressed mood and/or loss of interest or pleasure in all or almost all activities most of the day, nearly every day and the presence of a majority of the following symptoms; appetite problems, sleep problems, motor problems, lack of concentration, loss of energy, poor self esteem and suicidality.

Depression has been extensively studied in relation to mothers in the postnatal period, since the early months after birth are critical for the development of the mother-infant relationship and for subsequent child outcomes. In contrast there is sparse evidence whether depression in the postnatal period is associated with the father-infant relationship and in the resulting impact on child psycho-social adjustment.

1.1.1 Maternal postnatal depression

Postnatal depression (PND) in women is a common mood disorder linked to child birth and is defined as, 'any major unipolar depression occurring within the first postnatal year' (Davey, Dziurawiec, & O'Brien-Malone, 2006). Prevalence rates are around 13% in new mothers (O'Hara & Swain, 1996). PND is associated with a range of adverse outcomes in infancy including; cognitive deficits (L. Murray, Fiori-Cowley, Hooper, & Cooper, 1992), behavioural difficulties (Sinclair & Murray, 1998), interpersonal problems (A. Stein et al., 1991) and insecure attachment (Teti, Gelfand, Messenger, & Isabella, 1995). Continuity of disturbance is evident in childhood in the domains of cognitive (Hay et al., 2001) and socio-emotional (Essex, Klein, Miech, & Smider, 2001) functioning and in the increased rates of affective disorders in adolescence (Halligan, Herbert, Goodyer, & Murray, 2004).

Parents shape their child's emotional and social adjustment by providing a sensitive early environment. Research has consistently revealed a marked disturbance in the interactive behaviours of postnatally depressed mothers and their infants. Impaired interactions (i.e. withdrawn and intrusive behaviours) are reported in depressed mothers from diverse samples including both disadvantaged populations (T. M. Field, Healy, Goldstein, & Guthertz, 1990; T. M. Field et al., 1988) and low risk groups (Campbell, Cohn, & Meyers, 1995; L. Murray, Fiori-Cowley, Hooper, & Cooper, 1996).

The field has progressed beyond an understanding of the impact of maternal PND on child development to the identification of potential mechanisms of risk transmission (S. H. Goodman & Gotlib, 1999). Early mother-infant interactions are a potential pathway by which maternal PND may lead to adverse child outcome(T. M. Field et

al., 1990; Teti & Gelfand, 1991). Moreover researchers argue that dysfunctional behaviours and associated cognitions provide the most precise explanation for a possible causal route rather than exposure to maternal depressive symptoms in isolation.

Postnatal depression in mothers impacts on their early interactive behaviours which in turn lead to adverse child outcomes. Infancy constitutes a 'sensitive period' (Bornstein, 1989) in a child's developmental history, since the infant is extremely susceptible, dependent and receptive to its early environment and the long lasting impact that this influence may exert.

1.1.2 What about fathers?

While the majority of research on depression in the postnatal period has focused on mothers; the impact of paternal depression in early infancy has been largely underrepresented. This gap in the literature is surprising, given our developing understanding of: (i) the father's role in their child's normative developmental processes (C. Lewis & Lamb, 2003), (ii) the increased risk of behavioural and psychological maladjustment in children of fathers depressed at latter time points across development (V. Phares & Compas, 1992) (iii) increased paternal involvement in prenatal education, child birth, infant bonding and child-care (Davey et al., 2006) and (iv) the gradual recognition that the postnatal period is accompanied by much adaptation for both mothers and fathers; evident in the increase in depressive symptoms in men whose partners are depressed (Lovestone & Kumar, 1993) and the decline in both physical and psychological health in fathers inexperienced with child care (Ferketich & Mercer, 1995) and finally (v) knowledge

of the multiple determinants of father involvement including paternal psychopathology (Volling & Belsky, 1991).

Early risk to the child could stem from both maternal and paternal psychopathology. A systematic investigation of the early environment is thus crucial to understanding the father's unique role in child functioning, rather than concentrating exclusively on the mother and subsequently drawing broad based conclusions of 'parental' influence. The majority of previous research focusing on the maternal contribution may result in only one part of the parental influence being understood, resulting in potential paternal developmental pathways remaining unidentified or misattributed.

This thesis will focus on the father's role in early infancy; by examining the impact of paternal depression in the postnatal period on the interactive behaviours of fathers and their three month old infants.

1.1.3 Chapter layout

This chapter is an introduction to the broad subject matter which constitutes the framework of this thesis. The sections below focus on: the extent to which fathers are included in research, the father's role in child development, depression in fathers in the postnatal period, the impact of paternal depression on adverse child outcomes, parenting linked to paternal depression and potential mechanisms involved in the intergenerational transmission of risk.

1.2 Research on fathers: A neglected area?

Over three decades ago the article, 'Fathers: Forgotten contributors to child development' (M.E. Lamb, 1975) recognised the lack of research addressing the father's role in child development. Has their contribution evolved over this time?

In reviewing the growth of the field through the 1990's paternal research has focused on four areas namely; fatherhood across cultures, defining paternal involvement, paternal role in normative developmental processes and the conception of fatherhood identity in men (Marsiglio, Amato, Day, & Lamb, 2000). It does however appear that fathers are relatively excluded from developmental psychopathology research (Cassano, Adrian, Veits, & Zeman, 2006) as suggested by a number of studies.

Caplan and Hall-McCorquodale (1985) reviewed 125 articles on various child psychopathologies, published from 1970 to 1982. 53% of their sample included the mother's influence on the child's mental health. The study reported a five times increased rate of child psychopathology linked to mothers in comparison to fathers. 77% of the studies examined mother-child interactions compared to the 49% representation of father-child interactions.

Phares (1992) reviewed articles on child psychopathology linked to clinically-referred and non referred fathers and infants. Their sample of 577 articles published between 1984 and 1991; suggest that a larger percentage of research i.e. 48% included mothers only as opposed to the 1% focus on fathers. 25% of research

included both mothers and fathers and data was combined to represent a joint parenting variable, whilst 26% analysed maternal and paternal data separately.

Zimmermann, Salem and Notaro (2000) included studies conducted between 1993 and 1997 and their results replicated previous reviews; a substantial proportion of research was conducted on mothers or that data on mothers and fathers was analysed jointly. Phares, Field, Kamboukos & Lopez (2005a) updated their earlier findings to include articles published between 1996 and 2003 and continued to identify an under representation of fathers in research on child development. Of the 514 reports included; 2% included fathers only, 45% involved mothers only, 25% included mothers and fathers and analyzed them separately and 28% included both parents but did not examine them separately.

More recent findings of articles published between 1992 to 2005 (Cassano et al., 2006) suggest that fathers continue to be underrepresented in research, however further analyses revealed that over the 7-year period (1992-1998) more research was available on fathers and there were higher rates of paternal research involvement in older children.

1.2.1 Why are fathers neglected in the study of child and family functioning?

A number of reasons might help explain the above findings: (i) the majority of theories of child development are based on the maternal influence, (ii) the changing family structure; many children may be brought up within single parent homes i.e. by their mothers only and may have infrequent contact or no contact with their fathers, and (iii) difficulties in recruiting fathers; their unwillingness to participate in research.

1.3 The father's role in child development

There has been a growing interest in studying father's influences on children (Bögels, Bamelis, & van der Bruggen, 2008; M.E. Lamb, 2004). Some of the earliest studies on the paternal influence conducted between 1940 and 1970, examining an association between masculinity in fathers and sons were based on the father's role as a sex role model. Findings emerged that sons wanted to be like their fathers in the context of a positive father-son relationship, which prompted researchers to redirect their focus on the latter rather than on paternal masculinity. This shift led to the examination of specific paternal characteristics for example, the association between increased paternal warmth and child psychosocial adjustment and intellectual development (Radin, 1972). At the same time there were developments in the area of paternal absence and divorce linked to child outcome. Child adjustment and more specifically, the development of boys in father absent homes were compromised. Researchers drew conclusions from these early studies that worse child outcome was not merely because of the absence of a sex-role model, but the lack of paternal economic, emotional, social and behavioural contributions (Blanchard & Biller, 1971).

Since then research has focused on both *direct* pathways of paternal influence; for example, in the direct care of the child and *indirect* routes; for example, economically providing for the child and through the provision of emotional support to the mother (M. E. Cummings & O'Reilly, 1997). Paternal influence is evident across developmental domains (i.e. emotional, cognitive and social) and time points (i.e. during infancy, the pre-school years and in adolescence).

1.3.1 Fathers: *The significant other* contributor to child development?

1.3.1.1 Paternal influence in early childhood

Diverse features of paternal interactive behaviours are associated with early emotional competence, cognitive adjustment and attachment security.

Yarrow et al., (1984) found that paternal stimulation (socially mediated sensory stimulation and attention focusing activities) was associated with the development of mastery motivation (striving for competence) in infants aged 12 months. Volling, McElwain, Notaro & Herrera (2002) report that paternal emotional availability at 12 months was associated with the infant's emotional competence at 16 months. Infant's who were insecurely attached to their fathers, displayed increased negative affect in free play compared to securely attached infants.

Wachs, Uzgiris and Hunt (1971) found that paternal stimulation and the use of descriptive speech were linked to increased cognitive performance in infants ranging in age from 7 to 22 months. Shannon, Tamis-LeMonda, London & Cabrera (2002) report that in a low-income ethnically diverse sample; fathers who scored high on emotional attunement with the infant and stimulating play were nearly five times more likely to have children score within the normal range on cognitive adjustment, compared to those scoring low on interaction. Magill-Evans and Harrison (1999) report that paternal sensitivity at 3 and 12 months is linked to linguistic and cognitive development at 18 months, while Yogman et al., (1995) found that paternal involvement in pre-term infants had an influence on infant IQ after controlling for socio-economic factors.

Chibucos and Kail (1981) reported that paternal sensitivity at 2 months predicted secure infant attachment at 7½ months. Similarly Cox, Owen, Henderson and Margand (1992) found that fathers who were more affectionate and involved with their 3- month old infants, were more likely to have securely attached infants at 12-months.

Overall, findings point towards a consistent association between diverse dimensions of paternal parenting and adjustment in early childhood.

1.3.1.2 Paternal influence in toddlerhood and the preschool years

Evidence of the father's contribution to their child's development continues into toddlerhood and the pre-school years. Paternal nurturing behaviours (reading, teaching the child to count) are associated with an increase in child IQ (Radin, 1973). Black and Logan (1995) found an association between responsive communication (turn-taking skills and utterance type) and the child's competence with peers at 24-60 months. Yongblade and Belsky (1992) examined the impact of father-child relationships, measured at 1 and 3 years and the child's relationship with a close friend at 5 years of age. Their results suggest that children who experienced paternal negativity and intrusiveness were in more negative relationships with peers compared to children with less negative father-child relationships. Similarly in examining the paternal role in the development of sibling relationships, Volling and Belsky (1992) found that facilitative and affectionate fathering was associated with prosocial sibling interaction. Also in the domain of social development other researchers have reported; an association between paternal physical play and children's peer relations, especially for boys (MacDonald & Parke, 1984), an association between paternal positive affect and first grade-teacher ratings of social

competence (Isley, O'Neil, Clatfelter, & Parke, 1999) and the fathers role in emotional communication in early peer relations, more specifically, fathers who respond to their child's negative affect with increased negative affect of their own, have children who share less, show increased aggression and avoidance of others (J. L. Carson & Parke, 1996). In the cognitive domain, paternal sensitivity was associated with toddler's problem solving (Easterbrooks & Goldberg, 1984), scaffolding during teaching interactions predicted problem solving and literacy skills in children aged 2 years (Conner, Knight, & Cross, 1997) and nurturing play behaviours among low-income African American fathers and their infants predicted increased cognitive and language skills in children aged 3 years (M. M. Black, Dubowitz, & Starr, 1999).

1.3.1.3 Paternal influence in adolescence and beyond

Fathers continue to contribute to adolescent development, corresponding to reports from earlier time points. For example, Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheurer-Englisch and Zimmermann (2002) found that paternal sensitivity in free play at 2 years predicted attachment security in the child aged 16 years. Flouri and Buchanan (2002a) found that paternal involvement at age 7 predicted closer father-child relationships in adolescents aged 16 years, and fewer contacts with the police as reported by mothers and teachers.

Other longitudinal studies have reported that earlier paternal involvement predicts more positive spousal relationships and self-reported parenting skills (Burns & Dunlop, 1998) and that paternal hostility directed at 16 year old children predicts increased hostility in the children when they reach 25 years of age as reported by close friends (Allen, Hauser, O'Connor, & Bell, 2002). Paternal involvement at 7

predicts positive outcomes at 16 years, which in turn predict marital satisfaction and diminished psychological distress at 33 years (Flouri & Buchanan, 2002b).

The above findings highlight the different aspects of paternal engagement which have a vital and diverse impact on the child's psychosocial functioning. These studies also suggest that the environment in which the child develops is not restricted to the mother; fathers make an important contribution.

1.4 Paternal depression in the postnatal period

Researchers and clinicians are increasingly recognizing the psychological impact of the transition to parenthood in men (Deater-Deckard, Pickering, Dunn, & Golding, 1998). This interest has been driven by evidence indicating that depression in one parent is correlated to depression in the other (Ballard, Davis, Cullen, Mohan, & Dean, 1994), that paternal postnatal depression has a specific and adverse impact on; early behavioural and emotional development (Ramchandani, Stein, Evans, & O'Connor, 2005), marital functioning (Jacob & Johnson, 1997) and family communication (Jacob & Johnson, 2001) and the increased risk to the child when both parents are depressed (Carro, Grant, Gotlib, & Compass, 1993).

The prevalence of depression postnatally in community samples ranges from 1.2-25.5% (J. H. Goodman, 2004). This wide range is attributable to different measures used, variations in cut-off scores, assessment times and cultural and SES differences among samples. Depression in fathers tends to develop more gradually than PND in mothers. Areias, Kumar, Barros and Figueiredo (1996) report that in a study of 42

new fathers, 4.8% were depressed during the first three months, whilst 28.6% were depressed during the first year postpartum. Paternal postnatal depression is not a momentary phenomenon; 60% of fathers diagnosed with depression after birth continue to exhibit symptoms at 6 months follow-up (Zelkowitz & Milet, 2001).

Depression in males is more likely to manifest in their social behaviours including, increased withdrawal, indecisiveness and irritable mood (Williamson, 1987). Moreover men are more likely to express cynicism and hostility during a depressive episode (Brummett et al., 2000) as opposed to females. The few studies reporting on comorbid psychopathology indicate; the co-occurrence of anxiety and Obsessive Compulsive Disorder (Matthey, Barnett, Howie, & Kavanagh, 2003; Zelkowitz & Milet, 2001), somatic complaints, such as irritability, nervousness and restlessness (Clinton, 1987) and alcoholism (Eiden, Chavez, & Leonard, 1999).

In a review of 20 research studies Goodman (2004) identified the main predictors of postnatal depression in fathers including; previous depressive symptoms, the quality of their relationship with their partner and the presence of depression in the mother. The latter was identified as being the most important factor associated with paternal postnatal depression. Maternal depression is an important risk factor for paternal depression (Ballard & Davies, 1996; Deater-Deckard et al., 1998; Harvey & McGrath, 1988). Further, Matthey, Barnett, Ungerer and Waters (2000) report that fathers whose partners have PND are at a 2.5 times increased risk of developing depressive symptoms themselves, compared to fathers whose partners are not depressed.

Other variables indicated to increase the risk of depression include poor social functioning and employment status. Experience of a previous history of depression,

parental loss before 17 years, adolescent fatherhood and stress inducing situations (single fathers, birth of a high risk or preterm infant and marital dysfunction) have additionally contributed to the risk of depression in men (Spector, 2006).

Depression in new fathers is being acknowledged and recognized by clinicians. The literature described above suggests that the postnatal period does leave fathers vulnerable to the risk of depression. The maternal literature suggests that children of depressed mothers are at an increased risk of psychosocial problems and that impaired interactions may help explain this association. Whether comparable findings are evident in the paternal literature is addressed in the following sections.

1.5 Paternal depression and child outcome

A number of reviews have found that paternal depression is associated with a range of negative outcomes in children (Compas, Howell, Phares, Williams, & Ledoux, 1989a, 1989b; A. M. Connell & Goodman, 2002; Kane & Garber, 2004b; V. Phares & Compas, 1992; Ramchandani & Psychogiou, 2009).

Kane and Garber (2004a) applied meta-analytic procedures to address the association between paternal depression and children's internalizing and externalizing psychopathology. Paternal depression was significantly related to internalizing and externalizing behaviours in children and conflict in the father-child relationship. Low & Stocker (2005) report a direct association between paternal depression and children's externalizing problems in a community based sample. This finding has also been reported by Connell & Goodman (2001) and Brennan, Hammen, Katz &

LeBrocque (2002). Studies on school aged children and adolescents have also shown an association between depression and an increased risk for emotional and behavioural problems (Jacob & Leonard, 1986; Klein, Clark, Dansky, & Margolis, 1988; Orvaschel, Walsh-Allis, & Ye, 1988). Other studies have linked paternal depression to adverse cognitive development in infancy (Wanless, Rosenkoetter, & McClelland, 2008), increased prosocial and peer problems in children aged between four and six years (Dave, Sherr, Senior, & Nazareth, 2008) and the increased risk of conduct problems in offspring aged six to twenty years (Nomura, Warner, & Wickramaratne, 2001).

To our knowledge there are three studies which address the specific influence of depression in infancy on child development (Carro et al., 1993; Paulson, Keefe, & Leiferman, 2009; Ramchandani et al., 2005; Ramchandani et al., 2008).

Carro et al., (1993) report that paternal depressive symptoms (assessed using the Beck Depression Inventory, BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) one month postnatally predicted child internalizing and externalizing behaviours on the Child Behaviour Checklist, CBCL (Achenbach, Edelbrock, & Howell, 1987) at 2-3 years. Their results suggest a proposed pathway to explain the impact of paternal postnatal depression; i.e. through a contribution to subsequent maternal distress and depressive symptoms.

Ramchandani et al., (2005) examined paternal depression 8 weeks post-birth using the Edinburgh Postnatal Depression Scale, EPDS (J. L. Cox, Holden, & Sagovsky, 1987b) and the subsequent development of behavioural and emotional difficulties in children aged 3.5 years using maternal reports on the Rutter revised preschool scales. Their findings suggest that children of postnatally depressed fathers are at an

increased risk of behaviour problems (conduct problems and hyperactivity) even after controlling for maternal depression and paternal depression at 21 months.

In the same population cohort study, Ramchandani et al., (2008) examined whether the association between paternal depression and child outcome measured at age 3.5 years, persists at age 7 years. Child emotional and behavioural outcomes were obtained from maternal reports on the SDQ at age 6 years and psychiatric functioning was measured at age 7 years using maternal and teacher reports on a structured psychiatric questionnaire. Paternal depression in the post natal period was associated with an increase in the risk of child psychiatric disorders, particularly oppositional defiant disorder and conduct disorder as well as deficits in social functioning. The increased risk for these disorders remained even after controlling for maternal postnatal depression and paternal education.

Paulson et al., (2009) examined an association between paternal depression, at 9-months and child expressive vocabulary at 24 months. Depression was measured using the Centre for Epidemiological Studies Depression (CES-D) and mothers rated their child's vocabulary using the MacArthur Communication Development Inventory (MCDI). Their results indicate that fathers who experienced increased depressive symptoms, had infants with lower vocabulary scores and this association was mediated by father's reading to the child.

The above studies suggest clear associations between paternal depression and adverse child outcome. The critical question that follows is; what are the mediating mechanisms which help explain this association? The maternal literature suggests that mother-child interactions are a potential pathway and this may also be the case for fathers.

1.6 Interactions of postnatally depressed fathers

Eight studies from the literature have investigated the influence of paternal depression on father's interactions with their children. Six of these studies conducted observational assessments of fathers-child interactions; of which four studies utilized self-report measures of depression (T. M. Field, Hossain, & Malphurs, 1999b; Jacob & Johnson, 1997; Lundy, 2002a; McElwain & Volling, 1999), one used a clinical diagnosis of depression (Forbes, Cohn, Allen, & Lewinsohn, 2004), and one measured paternal blues (Zaslow, Pedersen, Cain, Suwalsky, & Kramer, 1985). Two studies used self-report and interview measures of father-infant interactions and utilized self-report measures of depressive symptoms (Edhborg, Matthiesen, Lundh, & Widstrom, 2005; Paulson, Dauber, & Leiferman, 2006). A range of paternal and infant interactive behaviours during the first year have also been examined. These include; 'proximity' (Zaslow et al., 1985), 'intrusiveness' (McElwain & Volling, 1999), 'parental affect and physical play; infant affect' (Forbes et al., 2004), 'bonding' (Edhborg et al., 2005), 'synchrony' (Lundy, 2002b) and 'engagement in enrichment play activities' (Paulson et al., 2006); with the exception of Jacob and Johnson (1997) who examine 'parental communication'. A tabular representation of all these studies is presented in appendix 1A, p. 301 and they are described in more detail below.

In the first study of father-infant interactions in depressed fathers, Field et al., (1999b) compared the interactions of depressed and non-depressed fathers with their three to six month old infants. Their sample (N=80) representing low socio-economic status was divided into four groups (depressed (n=20) and non-depressed fathers (n=20) and depressed (n=20) and non-depressed mothers (n=20)), based on

depression scores on the Beck Depression Inventory (BDI). Group comparisons were made on parent and infant behaviours coded from a 3 minute face to face interaction, using the Interaction Rating Scale (IRS) Field (1980). Additionally parental interactive style was coded as; *'intrusive', 'withdrawn' or 'positive'*. There were no reported differences in the interactions of depressed and non-depressed fathers. Depressed father's interactions were rated as more positive than both depressed and non-depressed maternal interactions, on both paternal and infant behaviours.

McElwain and Volling (1999) studied the impact of depressed mood on parental intrusive behaviour during a 15 minute free-play session and an open ended teaching task in sixty-two middle-class families with their 12-month old infants. Depressed mood was measured using the BDI. 'Parent-centered behaviour' (*intrusiveness)* was coded on a four point scale (ranging from 0= no intrusive behaviours to 3= 'repeated or intense episodes') for each 15 second interval. Analyses suggested that depression predicted less paternal intrusiveness during free-play. The same results were not evident in the teaching-task session. This study also suggests that the term *intrusiveness* used within the maternal literature (Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986), may have a different connotation to that applied in the paternal context.

Lundy et al., (2002b) examined the impact of paternal depression on interactions, in the context of exploring the relations among paternal socio-psychological factors, synchrony and attachment, in 15 fathers of lower-middle SES and their six month old infants. Paternal depression was measured using the Center for Epidemiological Studies-Depression Scale (CES-D) and a six minute face to face interaction was coded for s*ynchrony*. Results indicate that paternal depression was not related to the

frequency of synchronised interactions in fathers, rather lower marital quality predicted fewer father-infant synchronized interactions.

Jacob and Johnson (1997) examine the impact of paternal depression in 10-18 year old children. Depression was assessed using the BDI and the Minnesota Multiphasic Personality Inventory Scale 2 (MMPI) to determine fathers with current depression (n=50) and those with no current psychopathology (n=50). Fathers and their children were observed in a 15 minute problem solving discussion and interactions were coded for; '*positivity, negativity, problem solving and congeniality*'. Parental depression was linked to less *positivity* (more disapproval, disagreement and contradictions) and *congeniality* (less humour, laughter and smiles) in interactions. Further in reporting that negative communication patterns moderated the impact of depression on adverse child outcome; the authors have highlighted a possible pathway in the transmission of risk from parent to child, i.e. via parent-child communication style.

The study by Zaslow et al., (1985) was the first to address whether paternal depression impacted on early interactions. Their sample consisted of 37 middle-class fathers and their 4-month old first borns. Paternal 'blues' were assessed through a series of interview questions concerning the onset, intensity and maintaining and contributing factors of depressed feelings. Paternal behaviours were measured from observations lasting an hour when fathers, mothers and infants carried on with their normal routine tasks. The following behaviours were analysed: (i) smiles, vocalisations, mutual gaze, (ii) tactile stimulation, (iii) care-giving behaviours and (iv) social play involving, praise, affection, scaffolding. Results indicate that fathers who reported prolonged depressed mood (eight or more days of depressed mood) touched their infants less often and engaged in fewer care giving activities (relating

to the infant's physical needs) compared to those with no depressed mood. This study in spite of its small sample size (n=11 who reported blues and n=14 who didn't report any blues), lack of a diagnostic measure of depression and triadic rather than dyadic observations provides interesting evidence. First, the behaviours of depressed fathers reflect a *withdrawn* interactive profile and that those behaviours influenced by depression such as touch, are most likely to fit the paternal repertoire and expressed by fathers as early as 4-months. Second, depression might have a differential impact on older middle-class families as opposed to younger, families or those from lower socio-economic functioning.

Forbes et al., (2004) examined whether differences in parental affect and physicality are indicative of infant affect 3 and 6 months post-birth. This was the only study to use the Structured Clinical Interview for Axis 1 DSM-IV Disorders (SCID) (to identify fathers who met criteria for current and past depression) in addition to self-report measures of depression using the CES-D. Of the fifty fathers who participated, one father met criteria for current depression at both 3 and 6 months and nine fathers met criteria for past depression at 3 months. Interactions were coded for paternal and infant affect and paternal physicality from a 3-minute normal interaction and a 2-minute still face interaction. Results are reported across both time points, however due to the small number of depressed fathers they reflect *'parental depression'* effects on infant affect rather than individual effects of maternal and paternal depression. Infants whose parents reported a history of depression were less likely to display positivity albeit in mother-infant interactions at 3-months. Additionally at 3-months infants of parents with a history of depression were more negative during the still-face condition. Continuous scores on the CES-D suggested low, non-significant correlations between current depressive symptoms and parental positive affect. The

study has interesting implications in spite of having a small sample size and indistinct presentation of findings. The rates of depression in fathers is very low and whether effects found in mothers is linked to the higher prevalence of depression in women needs further investigation. Links of parental history of depression to current infant affect suggests that both current and more chronic depressive effects may impact on the developing infant and research distinguishing the occurrence of both acute and chronic effects in fathers would be an important undertaking.

The above studies provide conflicting evidence on the links between paternal depression and father-infant interactions. While some studies report no differences between the interactions of depressed and non-depressed fathers (T. Field, Hossain, & Malphurs, 1999a; Forbes et al., 2004), others suggest depressed fathers are more likely to be withdrawn (Paulson et al., 2006), experience difficulty forming a relationship with the infant (Edhborg et al., 2005) or express negativity in their communications (Jacob & Johnson, 1997). To date most studies have used self-report measures of depression with the exception of one study which used clinical interviews to diagnose depressive symptoms but their sample size of currently depressed fathers was inadequate to perform analysis, hence they used a continuous measure of depression from self-report measures. Studies have utilized small samples, possibly because of the difficulties experienced in the recruitment of fathers and the different methods of recruitment yielding varying response rates (Sherr, Dav, Lucas, Senior, & Nazareth, 2006).

1.7 The transmission of risk from parent to child

Relative to research on the range of adverse outcomes for children of depressed parents, knowledge on the mechanisms that underlie the risk for these outcomes in fathers is still limited. Consequently, literature on existing models on the pathway between maternal depression and child pathology (S. H. Goodman & Gotlib, 1999; L. Murray & Cooper, 1997a) have been utilized, to understand possible causal routes in fathers.

Murray and Cooper (1997b) explain the link between postnatal depression in mothers and adverse infant outcome through: (i) direct exposure to parental symptoms, (ii) parenting difficulties as a result of depressive symptomatology and lastly via (iii) third factor variables i.e. social adversity, genetic and constitution factors. Exposure to direct effects of parental symptoms (unpredictable, irrational behaviour, depressive affect) has been identified as the strongest pathway. Children exposed to *severe* rather than mild postnatal depression symptoms have an increased risk of poor cognitive development and insecure attachment security (Lyons-Ruth, Zoll, Connell, & Grunebaum, 1986): cited in Murray and Cooper, 1997) and those exposed to *chronic* depressive symptoms rather than a brief episode exhibit more behaviour deficits (Campbell, 1995). Children of depressed parents are not only exposed to the risks of overt depressive symptoms but also to indirect deficits by disruptions in parenting. For example, depression may cause parental withdrawal and preoccupation, resulting in the child being exposed to uncommunicative and unresponsive parenting. Children of parents with unipolar depression have a 9.1% risk of developing the illness (Manning & Gregorie, 2006) and twin and adoption

studies provide evidence of a genetic component to the transmission of risk. Further parents presenting with psychopathology are at a greater risk of economic disadvantage, unemployment and marital conflict and evidence suggests that social and personal difficulties are themselves related to adverse child outcome. Hence the link between postnatal depression and adverse outcome may be explained in part by environmental adversity.

Goodman and Gotlib (1999) have proposed four mechanisms through which depression is linked to adverse child development: (i) genetic factors, (ii) dysfunctional neuroregulatory mechanisms (iii) exposure to maternal negative cognitions, affect and behaviour and (iv) familial stress associated with depression. This 'integrative model' (*p*.460) considers biological and environmental dispositions, bidirectional influences between risk mechanisms and potential moderators (i.e. paternal health and involvement, characteristics of depressive episode and individual differences in the child).

The first biological pathway; i.e. a genetic predisposition to depression suggests that, children of depressed parents inherit genes (DNA) from the parent, which may directly increase the risk of pathology. Alternatively, children of depressed parents are more vulnerable to cognitive, personality, and interpersonal deficits which indirectly increases their risk for depression.

The second biological pathway advocates that children of depressed mothers have neuroregulatory abnormalities as a result of either genetic factors or adverse foetal development. The developing foetus may be exposed to neuroendocrine abnormalities (increased cortisol levels, reduced blood flow, exposure to smoking) as a result of maternal depression during pregnancy. The resulting dysfunctional

behavioural features or traits at birth may increase the child's vulnerability to future depression; alternately in the presence of certain environment triggers depressive characteristics are more likely to emerge.

The third mechanism involving interpersonal difficulties between a depressed parent and child comprises five aspects including: (i) the presence of negative cognitions, affect and behaviour in depressed parents, (ii) the resulting dysfunctional interactions, (iii) their impact on the child's social and cognitive functioning, (iv) modelling parental behaviours through social learning mechanisms and (v) the child's depressogenic cognitive style increases their risk for developing depression. Cognitive functioning in relation to depression is discussed in chapter 5 (p.171). Briefly, depressed parents are more negative about their parenting skills, more self-focused, the content of their speech is more likely to be negative, and they express sad and irritable affect and are more likely to engage in conflictual interactions (Cohn, Campbell, Matias, & Hopkins, 1990; T. M. Field et al., 1990; Gelfand & Teti, 1990; Ingram, 1990). Evidence suggests different interactional difficulties arising at various developmental stages as a result of depression. They include decreased; stimulation (Livingood, Daen, & Smith, 1983), responsiveness (T. M. Field, 1984) and affectionate contact in infancy (Fleming, Ruble, Flett, & Shaul, 1988), reduced episodes of sustained attention in toddlers and pre-schoolers (Breznitz & Friedman, 1988) and increased criticism and lower tolerance for behaviour in school-aged children and adolescents (Webster-Stratton & Hammond, 1999). The third aspect of this mechanism taps into the impact of depression on the child's development and that dysfunctional outcomes are linked to parenting. Several investigators have found that depression impacts on child functioning (p.14) and others have examined the mediating role of parenting on the association between depression and child outcome

to suggest that both negative and positive aspects of parenting impact on child outcome. That children model their parent's cognitions and behaviour through direct exposure, modelling or other social learning mechanisms (i.e. the experience of frequent criticism) constitutes the next feature of this pathway. There is evidence to suggest that children of depressed parents are less responsive, active, and content, some display heightened emotionality whilst others suppress their emotions and seem to be less distressed during episodes of maternal separation (T. M. Field et al., 1985).

The fourth mechanism includes environmental stressors that children of depressed parents are exposed to. These include marital conflict, socio-economic functioning, stressful life-events and social relationships; which have been found to be significant predictors of child functioning (Billings & Moos, 1983; Fendrich, Warner, & Weissman, 1990).

What mechanisms are responsible for paternal risk transmission?

The above pathways could potentially operate for fathers as well (V. Phares & Compas, 1992). In this thesis a specific pathway from the above models is utilized i.e., parenting difficulties as proposed by Murray and Cooper and the exposure to dysfunctional cognitions, affect and behaviour recognized by Goodman and Gotlib. Studies in older children have found hostile (Low & Stocker, 2005), conflictual (Kane & Garber, 2009) and punitive (Leinonen, Solantaus, & Punamki, 2003) paternal behaviours as a potential pathway. This thesis will be the first to examine whether paternal behaviours as early as three months are a mechanism in the transmission of risk in depressed fathers.

1.8 Aims of the thesis

This thesis aims to examine:

A. The influence of paternal depression in the postnatal period on father-infant interactions.

B. The potential mediating role of father-infant interactions in the development of later externalizing child outcomes.

The following specific research questions and related hypotheses are addressed[1]:

A. Are there differences in the interactions of depressed and non-depressed father-infant pairs?

Hypothesis 1: Depressed fathers and their infants will engage in less positive behaviours during face to face interactions compared to non-depressed father-infant pairs.

B. Are early father-infant interactions a potential mechanism in explaining the transmission of risk from the father to child?

Hypothesis 2: The association between paternal depression at 3 months and later child externalizing behaviours will be mediated in part by early father-infant interactions.

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[1] The chapters to follow address more specific hypotheses on paternal and infant behaviours.

1.9 Thesis structure

In Chapter 2 a systematic review is described, that was undertaken to examine the prospective association between direct observations of father-infant interactions early in children's lives and subsequent behavioural and cognitive outcomes in children.

In Chapter 3 differences in the interactions of currently depressed and non-depressed fathers and their three-month old infants (N=118) are examined, using a well-validated coding scheme; The Global Rating Scale: GRS (L. Murray, Fiori-Cowley et al., 1996).

In Chapter 4 the focus of measurement of the early father-infant interactive environment is broadened; by identifying constructs more characteristic of paternal interactions and related to theories of early parental influence. A new measure is developed as part of this study and described, The Paternal-Physicality Affect and Touch Scale (P-PATS). Using a matched study design; this coding scheme is used to re-examine the impact of paternal depression on a sub-sample of currently depressed and non-depressed fathers and their infants (N=38).

In Chapter 5 paternal cognitive biases and mentalizing comments in the communication of depressed and non-depressed fathers are investigated. A new measure is described; The Paternal-Cognitive Attributions and Mentalizing Scale (P-CAMS) and subsequently applied to examine the speech of a matched sample of depressed and non-depressed fathers (N=38).

In Chapter 6 a model of mediation by early father-infant interactions on the association between paternal depressive symptoms and child externalizing behaviours at 1 year is examined.

Finally, chapter 7 includes an assimilation and discussion of the main findings of this thesis, followed by the study implications, directions for future research and concluding remarks.

Chapter 2: Longitudinal studies of early father-infant interactions and developmental outcomes in children: A systematic literature review

2.1 Introduction

Early research on the parental role has focused on the mother as the main provider of an appropriate environment for the child's psycho-social adjustment; fathers in contrast, were assumed to take a peripheral role in their child's development (Barber, Stolz, & Olsen, 2005; Crockett, Eggebeen, & Hawkins, 1993; Furstenberg, Morgan, & Allison, 1987).

More recently however; research has begun to report the father's role in both normative child development (Chapter, 1, p.8) and in the development of child psychopathology (Chapter, 1, p.14). Moreover, studies have reported the negative impact of paternal absence on cognitive functioning (Mulkey, Crain, & Harrington, 1992; Pedersen, Rubenstein, & Yarrow, 1979), behaviour outcomes (Amato & Rezac, 1994; Dornbusch et al., 1985) and psychological adjustment (Flouri, 2007); providing additional evidence for the father's unique contribution to children's development over and above the maternal influence.

In the current study, a systematic review was undertaken to examine the prospective association between observed father-infant interactions and children's developmental outcomes. The process of combining studies is an effective way of drawing conclusions from a broader range of participants. There are several reasons which support an examination of this association: First, evidence suggests that fathers and mothers have differing interaction styles with their children. Fathers tend to engage in more physically stimulating interactions whilst mothers engage in more nurturing care-oriented social exchanges (Paquette, 2004a). The arousing and challenging aspects of paternal interactions thus challenge the child's ability and influence

development. This may well explain why father-child and mother-child communication provide unique relational perspectives for the child's development (Ryan, Martin, & Brooks-Gun, 2006; Stolz, Baber, & Olsen, 2005). The question then remains, as to the contribution of specific features of early paternal interactions on subsequent child behaviour.

Second, children who experience sensitive parenting from fathers are more likely to experience maternal warmth and sensitivity, or vice versa. The consequence of having two involved parents suggests that the child is more likely raised in an over-all positive environment which may enhance functioning and differentiate between those from less stimulating environments. A second sensitive parent complements the benefit of the first by providing a consistent parenting environment, leading to positive parental interactions and in turn positive child outcomes (J. Belsky, Gilstrap, & Rovine, 1984; Ryan et al., 2006).

Third, the timing of paternal influence is also likely to impact on child outcomes. 'Infancy is described as a critical time for parents to respond in a warm and sensitive manner in order to provide a strong foundation for children's later development' (Landry, Smith, Swank, Assel, & Vellet, 2001). Social exchange through early non-verbal communication with a parent enables the infant to absorb information from their environment and apply it to subsequent exchange. Supportive parenting behaviours thus provide the foundation that allows the development of immature infant skills to positive outcomes in childhood and adolescence. Moreover parental influence may be the strongest in early childhood when there are fewer competing socialization influences (for example, teachers and peers). Alternatively in line with a 'process model of continuity' (Freitag, Belsky, Grossmann, Grossmann, & Scheuerer-Englisch, 1996), it might be reasonable to assume that early father-child

interactions are associated with child outcomes not merely due to the 'sensitive period' linked to development but because of a more stable pattern of behaviour across development. Whichever rationale one supports the results of longitudinal studies on the association between early interactive behaviours and later child outcomes raises the question of whether it is particularly important to address child outcomes in the context of the early parenting environment.

Fourth, we consider it a timely undertaking to examine the association between father-child interaction and child outcomes because the field is in a transitional stage in the development of a theoretical framework for understanding the paternal role(Stolz et al., 2005). We are not aware of any reviews that have examined the longitudinal association between observed paternal behaviours present in the first two years and child outcomes. Existing reviews have focused areas such as: paternal involvement (cohabitation, engagement and responsibility) in relation to child outcomes (Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008), the concurrent association between parental care giving and externalizing child behaviours (Rothbaum & Weisz, 1994) and the impact of non-resident fathers on children's well-being (Amato, 1999).

Finally, many of the existing reports on fathering and child outcome include maternal reports on paternal behaviours as well as child outcome (Baker & Heller, 1996; DeKlyen, Speltz, & Greenberg, 1998). This study reduces the risk of single informant bias by utilizing observational measures of sensitivity and parent reports of child outcome.

2.2 Aims

This study aims to review the existing literature for longitudinal studies examining the association between father-infant interactions (in the first 24 months of the child's life) and subsequent child outcomes. The following research question is addressed: Does paternal sensitivity measured in the context of observed father-infant interactions predict later child outcomes?

2.3 Methods

2.3.1 Retrieval of studies[2]

A literature search of studies published from 1967 through to 2008 presenting quantitative data on the association between father-infant interactions and child developmental outcomes was conducted. This involved a computer based literature search of the databases, PsychINFO, Medline, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Educational Resources Information Center (ERIC), Dissertation Abstracts International, Allied and Complementary Medicine (AMED), British Nursing Index Archive, Global Health, Health Management Information Consortium (HMIC). This computer search was supplemented by scanning reference lists of included studies and specific journals which have included paternal literature. Additionally researchers involved in paternal research in infancy

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[2] At the time of completion of this chapter we scanned the literature for additional studies published between May-2008 and July 2009 to update the previous search.

and early childhood were contacted with requests for published, unpublished reports and dissertations (Appendix 2A, p.310). The key words used in the search were a combination of the following concepts: (i) those relating to *parenting*, namely parenting, father-infant interaction, father-child interaction, father (s), fathering, paternal, paternal behaviour, child rearing, father-child relations, paternal involvement, paternal engagement, (ii) specific descriptions of *paternal behaviours*, namely sensitivity, synchrony, responsiveness, directiveness, (iii) *child outcome* terms, namely child outcome, developmental outcome, socialization, behaviour problems, emotional outcomes, social outcomes, behavioural outcomes, psycho-social outcomes, cognitive outcomes and language development (iv) *study design* terms, including longitudinal and prospective. During the initial search stage the retrieval of studies was not restricted by sample type (i.e. clinical, community or stressed samples).

2.3.2 Inclusion criteria

The criteria for including studies in the sample were as follows: First, studies had to include a prospective longitudinal design; the measurement of father-infant interaction preceded the outcome measure(s) by a minimum of 12 months. This time frame has been previously applied in a review of paternal involvement and child outcomes (Sarkadi et al., 2008).

Second, the studies included an observational measure of father-child interaction, assessed prior to or at 24 months post-birth. Included were observations of paternal behaviours only or a combination of interactive features, some focusing on the child, others on the parent or the dyad. Data on paternal and dyad features are included in the review. Occasionally studies measured father-infant interactions at multiple time-

points across the first two years and beyond. Two criteria were used for including them in the study; (i) where possible, data was extracted for associations between outcome and specific interaction measures at or before 24 months, (ii) when composite scores were derived from all time-points, we ensured that 50% and more of the observations were obtained prior to or at 24 months.

Third, studies were included in which the exploration of the current association was not the main goal. It was not uncommon that some of the empirical literature was found in studies addressing broader topics for example, parenting differences in mothers and fathers and child outcomes, antecedents of child outcome or interaction analysed as a mediator variable. On the other hand, certain article titles were misleading and were subsequently excluded; when 'parenting behaviours' represented the assessment of maternal parenting only and when the majority of findings were based on maternal interactions.

Fourth, studies with clinical samples selected on the basis of paternal psychopathology were excluded as they may yield different effects than would be found in non-clinical samples (R. Feldman & Eidelman, 2004; Lytton, 1990; Rothbaum & Weisz, 1994). However studies with samples of low-social functioning in the family, normally functioning premature infants or stressful life circumstances for example, multiple births were included and caution exercised in interpreting and assimilating their findings against low-risk samples.

Finally, references which relied on the same study were included if the outcomes measured were categorized under different domains of development or measured at different time points. References which included the same samples, conducted by the same research team and reporting similar associations were only included once.

Inclusion of multiple reports from one group of researchers may result in biased findings (Egger et al., 1997).

2.3.3 Information extracted

Information about the following variables was extracted from the studies: (i) *publication features:* year and source of publication, (ii) *design features:* including the number of participating fathers and method of recruitment, (iii) *infant and father demographic variables:* including mean ages, ethnic status, child gestational age, gender and birth order, paternal marital status, SES and education, (iv) *methodological features:* including type of interaction behaviour, i.e. a single variable or a combination of variables, timing of the interaction measure, context of measurement (home-based vs. laboratory based) and content of tasks (free-play vs. structured play); outcome measures, number of outcomes (single vs. multiple), timings for repeated measures of an outcome, definition of the outcome, measurement context (self-report vs. observational measures, vs. independent reporter) and (v) *methodological quality:* including analysis of attrition, reliability analysis of observational measures, use of blind coders, reporting of outcomes (self-report, vs. objective measures, paternal vs. maternal measures) and different assessors utilized for the measurement of interaction and subsequent outcome. An example of a completed data extraction form is presented in appendix 2B, p.311.

2.3.4 Independent variable

The construct of *paternal sensitivity* characterized the independent variable. The maternal literature suggests that sensitivity is a vital indicator of the quality of mother-child interactions and has thus been associated with a range of child outcomes. Since fathers, like mothers, are equally sensitive and positive towards

their infants (Braungart-Rieker, Garwood, Powers, & Notaro, 1998; Goossens & van Ijzendoorn, 1990; Parke, 2002; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004), it would therefore seem reasonable to study their sensitive behaviours in relation to child outcomes.

Sensitivity was defined as inclusive of the following behavioural dimensions; *responsiveness*, *synchronicity, positive affect and supportive engagement.* These behaviours have been the focus of early mother-infant interactions for decades and although they capture different interactional dimensions they often relate to one another and have been frequently combined (Nievar, 2008; Shannon, Tamis-LeMonda, & Cabrera, 2006). For example, mutually reciprocal interactions have been associated with positive emotions and the sharing of positive affect within mother-child dyads (G. Kochanska, 1997). Maternal behaviours defined as sensitivity, synchrony and mutuality have been grouped together and the influence of this overall sensitivity group has been examined in relation to attachment security (Nievar, 2008). Global measures of dyadic reciprocity and shared positive affect have demonstrated significant overlap with the shared initiation of behaviour in father-infant dyads (Lindsey, Cremeens, Colwell, & Caldera, 2009). Emotional warmth has been related to parental sensitivity during the expression of positive infant cues (Lohaus, Keller, Ball, Elben, & Voelker, 2001). Yet others have suggested that sensitivity is a multi-faceted construct; characterised by perception and interpretation of the child's cues and appropriate responsiveness to them and by additional features of emotional availability such as affective expression and the mutual exchange of key emotional features (Biringen & Robinson, 1991; Emde, 1980).

Multiple types of paternal behaviours defined in the included studies were identified and similarities drawn with the original definition of sensitivity. The term *sensitivity* was originally used to describe a mother who 'is able to see things from her baby's point of view. She is alert to perceive her baby's signals, interprets them accurately, and responds appropriately and promptly.....temporally contingent upon the baby's signals' (Ainsworth et al., 1978, *p.*142). In the current context the following terms were recognized to indicate the behavioural markers of sensitivity: *responsiveness* (contingent, prompt and appropriate responding, following the child's verbal and non-verbal initiatives), *synchronicity* (paternal behaviours that are congruent with the child's preceding behaviour; incorporating elements of affect attunement and mutual reciprocity of social experience and behavioural intension), *positive affect* (general qualities such as warmth and positive emotions, expressed both verbally and behaviourally), *supportive engagement* (directly supporting the child's active exploration and engagement of the environment through cooperation, attending to the child's communicative effort, direction and facilitation in relation to the child's developmental functioning).

In this framework of paternal sensitivity, we additionally acknowledge an adjustment in paternal behaviours across the four domains (i.e. *responsiveness*, *synchronicity, positive affect and supportive engagement)* as the infant develops. This ensured that sensitive paternal behaviours were developmentally appropriate. Previous research has indicated age appropriate behaviours in relation to maternal sensitivity measured over multiple time-points (R. Feldman, Eidelman, & Rotenberg, 2004). They include: acknowledgement and reciprocity in the infant's attempts to engage during face to face interaction (3 months), shared attention and exploration during dyadic play (6 months) and attunement to the toddlers symbolic expression during episodes

of joint play (end of the 1st year and into the 2nd). It would thus seem reasonable to recognize that an examination of early sensitivity on child development includes, diverse yet interrelated behavioural terms that share meaning across different contexts and ages.

2.3.5 Dependent variables

Two developmental domains were the main focus of outcome for this review: (i) behavioural development, (ii) cognitive – linguistic development. These outcome domains were chosen as they reflect the types of outcomes most often reported in the paternal literature. A third group consisted of those outcomes which could not be meaningfully combined and hence warrant separate representation. They include; friendship competence, internalization of parental rules, behavioural inhibition, false-belief understanding, self-regulation, self-recognition and attachment representation.

In the domain of *behavioural* development externalizing behaviours were examined. Theories of parent- child relations (Dix, 1991) have emphasized the importance of parental attunement with the child in promoting behavioural development. In their meta-analysis of 47 studies Rothbaum and Weisz (1994), reported that patterns of parenting referred to as 'acceptance-responsiveness' were negatively associated with child externalizing behaviours. Parental acceptance and responsiveness are linked to the child's positive adaptation and motivation towards non-coercive cooperation and socially acceptable behaviours (Maccoby, 1992). Parental warmth and positive affect are related to low levels of externalizing problems (Eisenberg et al., 2003). Evidence also suggests that more negative and less positive parenting predicts externalizing behaviours (J. Belsky, Hsieh, & Crnic, 1998; Campbell, Shaw, & Gilliom, 2000) and that parental negativity, insensitive and controlling strategies are associated with the

development and maintenance of conduct problems (Trautmann-Villalba, Gschwendt, Schmidt, & Laucht, 2006).

In the domain of specific *cognitive* development it has been proposed that parental sensitivity may enhance cognitive development through the provision of contingent support (van Bakel & Riksen-Walraven, 2002), scaffolding during learning activities (Rogoff, 1990) and joint problem solving (Gauvain & Rogoff, 1989). Cognitive development has been studied in relation to maternal reciprocity at 3 months (R. Feldman, Greenbaum, Yirmiya, & Mayes, 1996), joint manipulation of objects with the infant and the enhancement of exploratory skills at 6 months (R. Feldman, Weller, Sirota, & Eidelman, 2002; Kopp, 1982) and sensitive attunement to moment by moment changes in the infant's symbolic expressions at 1 year (Tamis-LeMonda and Bornstein, 1996).

In the *linguistic* domain, social interactions provide the context for the child's developing language milestones (Tamis-LeMonda, Bornstein, & Baumwell, 2001). Adults support the development of early vocabulary by; (i) contingently responding to the infant's visual, attentive and emotional state, (ii) sustaining joint visual foci, by using words to describe objects and events under joint attention and (iii) by utilizing attention focusing strategies to organize the child's attention during episodes of distraction (Baumwell, Tamis-LeMonda, & Bornstein, 1997). Empirical evidence reports that responsiveness relates to the acquisition of toddler speech and increase in vocabulary at two years (Olson, Bayles, & Bates, 1986). Joint attentional focus during unstructured play sessions during toddlerhood is associated with increased vocabulary (Tomasello & Todd, 1983). Organization of infant attention to objects and events in the environment is associated with increased receptive language skills in children (Tamis-LeMonda & Bornstein, 1989). Responsiveness measured at nine

and thirteen months predicted the timing of children achieving language milestones (Tamis-LeMonda et al., 2001).

2.4 Analytic strategy

Combining the results using meta-analytic procedures was deemed inappropriate owing to the heterogeneity of the studies in terms of; different time points utilized for the measurement of interaction and child outcomes, the length and nature of father-infant interactions (free-play vs. structured play, vs. a standard teaching session) and the measurement of outcome (observational, vs. parental report, vs. teacher reports vs. clinical evaluation of the child). The results are summarized by analyzing distributions and synthesizing data in the following areas; (i) selection process (ii) sample description (iii) father-child interactions, (iv.) developmental outcomes and (v) qualitative descriptions of studies examining an associations between paternal sensitivity and child outcomes.

2.5 Results

2.5.1 Selection process

Using a combination of the search terms (p.34) a total of 1217 publications were initially identified (Figure 2.1); after removing duplicate studies and narrowing the

range of potentially relevant ones, 646 studies remained in the pool. From this sample we excluded 595 studies on the basis of their titles and abstracts. A total of 51 publications were critically appraised. 35 studies were excluded from this sub-set (Appendix 2C, p.315). Exclusion categories include; (i) the timing of interaction data collected after 24 months (n=7), (ii) cross-sectional design (n=11), maternal data reported only (n=6), observational measures of interaction not included (n=3), (iii) duration between exposure and outcome <12 months (n=4), other reasons (n=4). A final sample of sixteen publications was identified.

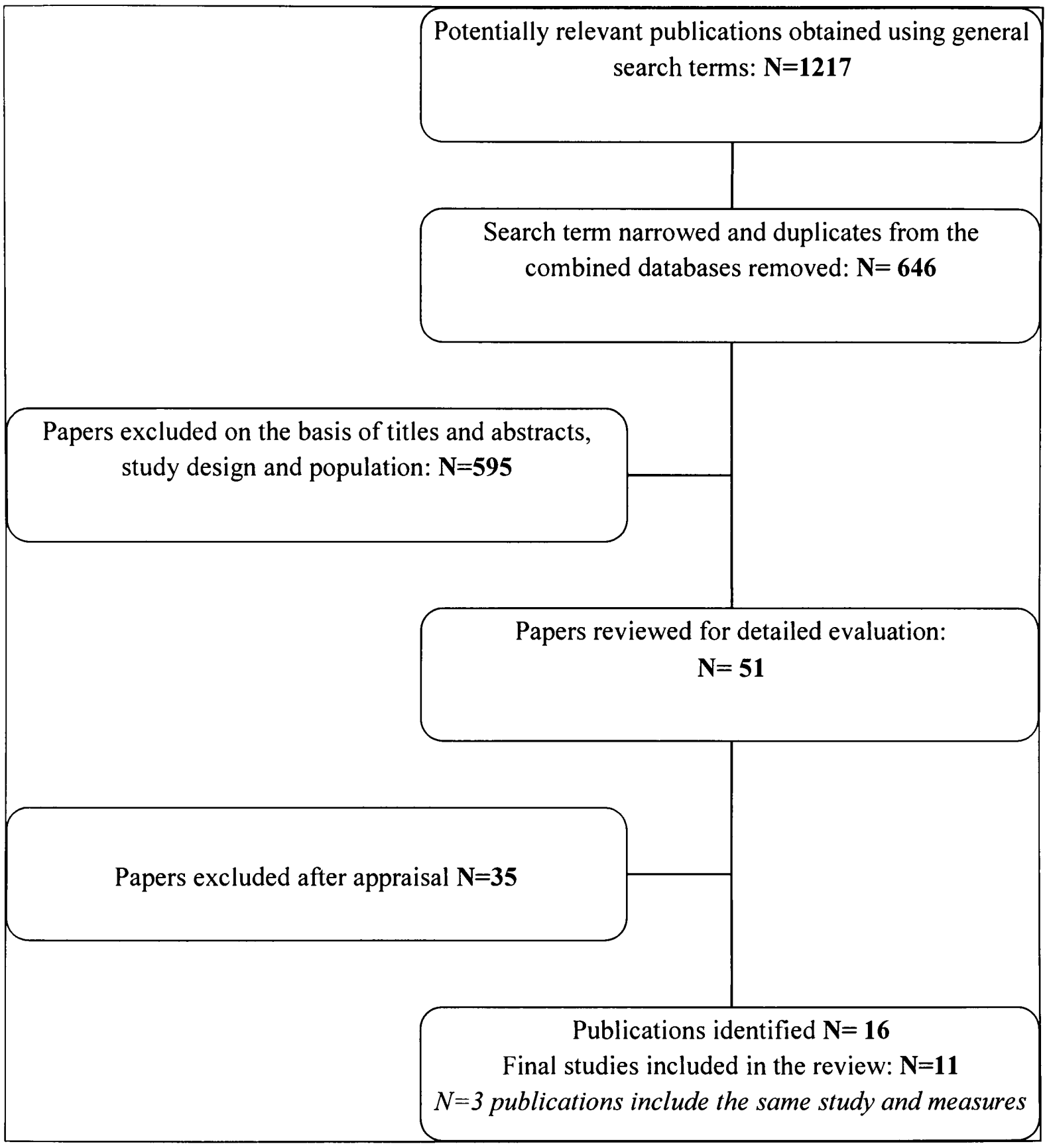


Figure2.1 Stages in the retrieval of relevant publications

2.5.2 Sample description

Sixteen publications initially met the inclusion criteria. From this pool three papers were excluded (Cabrera, Fitzgerald, Bradley, & Roggman, 2007; Park, Belsky, Putnam, & Crnic, 1997; Ryan et al., 2006) as they utilized the same sample, measures and time-points reported by Belsky et al., (1998) and Tamis-LeMonda et al., (2004) included in the current sample. Tamis-LeMonda et al., (2004), Ryan et al., (2006) and Cabrera et al., (2007) all report on fathers who participated in the National Early Head Start Evaluation study, whilst Belsky et al., (1998) and Park et al., (1997) use the same sample of '125 first born sons of maritally intact, middle and working class Caucasian families residing in central Pennsylvania'. Of the thirteen remaining publications three report data from the same study (Benzies, Harrison, & Magill-Evans, 1998; Magill-Evans & Harrison, 1999; Magill-Evans & Harrison, 2001). Since they include different outcome measures and utilize different time points they are all included. Characteristics of the final sample consisting of 13 publications from 11 studies are presented in table 2.1, p.45. A tabular presentation of all these studies is presented in appendix 2D, p.320.

Table 2.1 Sample description

Study/ publication characteristics	Analysis	Study/ publication characteristics	Analysis
Publications	**N=13**	**Infant gender***	
Studies	**N=11**	Males	694 (55.69)
Publication year	Range (1987-2000)	Females	514 (41.25)
1980s	1 (7.7)	**Infant birth order****	
1990s	3 (23.1)	First born	5 (45.45)
2000s	9 (69.2)	Second born	5 (45.45)
		Equal distribution	1 (9.09)
Sample size	**N= 1246** Range (24-290)	**Infant's age (months)** Time 1= IV collected	11.47 (7.24) Range (3-24)
1-49	3 (23.1)		
50-99	5 (38.5)	**Infant's age (months)** Time 2= DV collected	49.08 (33.92) Range (18-128)
100-199	4 (30.8)		
200-299	1 (7.7)	**Father's age (yrs)**	32.21 (2.16) Range (29-36)
Mode of recruitment		**Fathers ethnicity***	
Advertisements	2 (18.18)	>50% white	10 (90.90)
Postnatal wards	5 (45.45)	< 50% white	-
Birth records	2 (18.18)		-
Birth announcements	1 (9.09)		
Parenting classes	1 (9.09)		

Note: Data are presented as frequencies with % or means and standard deviations; *data in one study not indicated in the publication; ** number of studies reporting data on first born infants only, second born only and studies with an equal distribution; IV collected= time of gathering interaction data; DV collected= time of gathering the outcome data

2.5.3 Father-child interactions

Characteristics of the independent variable are presented in table 2.2.

Table 2.2 Characteristics of father-infant interactions (n= 13 publications)

Interaction characteristics	Analyses**
Duration of observations (minutes)	20.92 (20.89)
Duration between measurement of dependent and independent variable (months)	34.48 (37.04)
Multiple time points of the IV	
Single measure	6 (46.2)
Two time points	5 (38.5)
Three time points	1 (7.7)
Four time points	1 (7.7)
Location of measurement of interaction	
Home based	9 (69.2)
Laboratory based	3 (23.1)
Combination of home and laboratory based	1 (7.7)
Nature of interaction	
Free-play	5 (38.5)
Structured play	2 (15.4)
Semi-structured play	3 (23.1)
Standard teaching task	2 (15.4)
Observation of daily routine	1 (7.7)
Use of toys and other play materials	
No toys	4 (30.8)
Toys provided by the researcher	8 (61.5)
Other*	1 (7.7)

Note: **Data are presented as means and standard deviations or frequencies with % in parenthesis; *other = papers report using observation of daily routines and hence it is anticipated that toys and material would be present

2.5.4 Child outcome

The characteristics of the outcome measure are presented in table 2.3 below.

Table 2.3 Characteristics of outcome measures (n=13 publications)

Outcome characteristics	Frequency (%)
Infant's age at the measurement of outcome	
< 36 months	6 (46.2)
37-60 months	5 (38.5)
5.1-10 years	1 (7.7)
11-19 years	1 (7.7)
Time points	
Single	5 (38.5)
Multiple	8 (61.5)
Mode of measurement of outcome	
Observational	3 (23.1)
Questionnaire	3 (23.1)
Standardised evaluation	4 (30.8)
Combination of observational and questionnaire measures	1 (7.7)
Combination of child evaluation and observational measures	1(7.7)
All three measures utilized	1 (7.7)

Note: Data are presented as frequencies with % in parenthesis

2.5.5 The association between early interaction and child outcomes

In the following sections individual studies are presented according to the outcome domains examined and conclusions are based on comparisons across studies. Results from individual publications in all outcome domains are presented in tabular form in Appendix 2E, p.333.

2.5.5.1 Externalizing behaviours[3]

Four studies measured externalizing behaviours (J. Belsky et al., 1998; Benzies et al., 1998; R. Feldman & Eidelman, 2004; Trautmann-Villalba et al., 2006).

Benzies et al., (1998) investigated the association between paternal interactions with healthy term and pre-term infants (N=74; males: 42, females: 32) at 12 months and the development of behaviour problems between 42 and 54 months. Interactions were measured using a home-based standard teaching task, (The Nursing Child and Assessment Teaching Scale, NCATS, Sumner and Speitz, 1994) of 5-10 minute duration. A total score for paternal behaviours included; sensitivity to cues, responsiveness and stimulation (socio-emotional and cognitive). Behaviour problems were assessed with a parent-report questionnaire; The Eyberg Child Behaviour Inventory (ECBI, Eyberg, 1992) to yield an intensity score (frequency of occurrence) and a total problem score (behaviour perceived as being problematic to the rater).

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[3] Relevant statistical information has been extracted from the papers in all possible instances; however not all papers have reported exact *p*-values; specifically non-significant values are not indicated by some authors.

Correlational analysis demonstrated that paternal behaviours were not associated with either the intensity score (r = -.03, *ns*) nor the total problem score (r = .02, *ns*). Belsky et al., (1998) examined the impact of paternal sensitivity on externalizing behaviours at 37 months in a sample of 125 first born sons. Paternal behaviours were assessed over 60 minutes during dinner time across four time points 15, 21, 27 and 33 months. A composite measure of positive parenting was subsequently created by summing ratings for sensitivity *(awareness of the child's state and an adjustment in paternal behaviour to meet the child's goals and needs)*, positive affect *(verbal and non-verbal positive and affectionate expressions)*, cognitive stimulation and engagement. A composite for negative parenting was created by summing ratings on intrusiveness *(inserting paternal agenda's and goals on the child)* and negative affect. Finally a POS-NEG parenting composite was created by subtracting the negative parenting score from the positive score. Externalizing behaviours were measured using an average of maternal and paternal ratings on the Child Behaviour Checklist for 2-3 year olds (CBCL, (Achenbach, Edelbrock et al., 1987). A mean score was used as maternal and paternal ratings on the externalizing scale were significantly correlated (r = .56, $p<.001$). Regression analysis suggested that the cross-time grand composite fathering score (i.e. Pos-Neg 15 + 21 + 27 + 33) did not contribute to the prediction of externalizing problems (β = -.08, *ns*).

Feldman and Eidelman (2004) studied the influence of father-infant synchrony at 3-months on the development of behaviour problems at 24 months in a sample of 138 infants comprising; 3 sets of twins, 23 sets of triplets and 23 singleton infants. Fathers were videotaped in a 5-minute free-play context (no toys were provided) at home and behaviours were coded for the proportion of time the father and infant coordinated gaze, touch and vocalisation behaviours. At 24 months mothers rated

their child's behaviour problems using the CBCL/2-3 and three summary scores were derived; a total behaviour score, an internalizing symptoms score and an externalizing symptoms score. Results suggest that father-infant covocalization was associated with lower internalizing ($r = -.28$, $p < .05$) and externalizing ($r = -.30$, $p < .05$) problems. Gaze synchrony was related to lower internalizing problems ($r = -.28$, $p < .05$). Regression analyses suggest that parent-infant gaze synchrony predicted total problems ($\beta = -.31$, $p<.05$), externalizing symptoms ($\beta = -.27$, $p< .05$) and internalizing symptoms ($\beta = -.29$, $p< .05$).

Trautmann-Villalba et al., (2006) investigated an association between paternal interactional behaviours at 3 months and children's externalizing behaviour problems at ages 8 and 11 years in a sample of first born infants (N= 72; males: 37, females: 35). Fathers and infants participated in a 5-minute, laboratory based standardized nursing and play situation. Behaviours were coded for paternal sensitivity *(loving, close, vocalizing)*, positive emotionality (*smiling, looking at the infant, playing)* and non-responsiveness *(emotionally non-responsive, using physical play).* Mothers completed the Externalizing Problems Scale of the CBCL, reporting on the presence of aggressive and delinquent behaviours. Subsequently children were divided into high vs. low externalizing groups. The paper does not suggest how the outcome was summarized across the two time-points; data is examined for 'differences between high and low externalizing children by age 11 years' (*p*.346). Fathers of the high externalizing group were less sensitive at 3 months (M= -0.49, *SE*= 0.19) compared to those of the low externalizing group (M= 0.21, *SE*= 0.14); $F_{(1, 67)} = 8.24$, p=.005. Group differences were also evident for non-responsive paternal behaviours $F_{(1, 67)} = 5.17$, p=.026; the high externalizing group experiencing increased emotionally

unresponsive paternal behaviours (M= 0.32, *SE* = 0.19) compared to the low externalizing group (M= -0.22, *SE* = 0.14).

Summary

One must be cautious in drawing definitive conclusions with variable findings and a small number of studies (n=4). Whilst two studies found no evidence of effect (Benzies et al., 1998, Belsky, 1998), studies by Feldman and Eidelman (2004) and Trautmann-Villalba et al., (2006) show evidence of a large effect. It may be that an accurate assessment of effect would lie between these two points, and show evidence of a moderately sized association between paternal sensitivity and later child behavioural problems. This is what may have been concluded if a meta-analysis had been undertaken, but this conclusion should be treated with some caution.

2.5.5.2 Cognitive- linguistic development[4]

Five publications of four studies assessed the longitudinal association between early paternal behaviours and *cognitive development* (Hunter, McCarthy, MacTurk, & Vietze, 1987; Lindsey et al., 2009; Magill-Evans & Harrison, 1999; Magill-Evans & Harrison, 2001; Tamis-LeMonda et al., 2004).

Cognition

Tamis-LeMonda et al., (2004) explored an association between father-child interactions at 24 months and children's cognitive development at 36 months in a sample of low income families (N=111). Interactions were conducted at home for 10-minutes in a semi-structured free-play context. Paternal interactions were coded on six dimensions. Positive dimensions included; sensitivity *(accurate perception of*

[4] Under cognitive development is included cognition and language. We examine the influence of early interactions on each aspect separately.

the child's signals and prompt and appropriate responses), positive regard *(positive affect directed at the infant)* and cognitive stimulation *(teaching the child and facilitating the development of skills and knowledge)*. Negative dimensions included intrusiveness *(overcontrolling behaviour)*, detachment *(lack of engagement, withdrawn behaviour)* and negative regard *(expression of negative affect and rejection)*. Cognitive functioning was measured using the mental scale of the Bayley Scales of Infant Development (BSID-II; Bayley, 1993). MDI scores were associated with paternal sensitivity ($r = .30$, $p \leq .001$), positive regard ($r = .22$, $p \leq .01$) and cognitive stimulation ($r = .30$, $p \leq .001$). After controlling for demographic variables, supportive parenting (i.e. the sum of sensitivity, positive regard and cognitive stimulation) predicted cognitive outcome ($\beta = .25$, $p \leq .01$) independent of the maternal contribution.

Magill-Evans et al., (2001) studied the relationship between father-child interactions measured at 3 and 12 months and the child's cognitive development at 48 months. Participants included 44 healthy preterm and 49 full-term infants. Parent behaviours were observed using the NCATS. The Macarthy Scales of Children's Abilities (McCarthy, 1972) measured cognitive development. Results suggest that neither the 3 nor the 12 month interactions were associated with the General Cognitive Index at 48 months ($r = .02$, *ns* and $r = .06$, *ns* respectively).

Magill-Evans et al., (1999) examine cognitive functioning at 18 months using the mental scale of the BSID in the study reported above. Their analyses are conducted in two stages: (i) best predictors of cognitive functioning from four categories, i.e. paternal and maternal interactions, child and environmental factors and (ii) significant predictors across these categories. Paternal interactions were associated

with the Bayley Mental score in the first stage (figures are not available) but when entered with other predictors they did not predict outcome.

Hunter et al., (1987) examined an association between father-infant synchrony at 6 and 12 months and cognitive development at 30 months in a sample of first born infants (N= 66; males: 35, females: 31). Observations were conducted over 60 minutes when fathers went about their normal daily routines. Coding included object directed and vocalisation behaviours of fathers and their infants. Cognitive development was measured using the McCarthy Scales of Children's Abilities (MSCA; McCarthy, 1972). The results suggest that 6-month interaction measures did not predict cognitive outcomes at 30 months (figures not available). Similar results were reported for the association between 12 month joint action variables and child outcomes at 30 months: father-object play and infant vocalize (r = .11, *ns*); father-object play and infant object play (r = .12, *ns*); father-vocalize and infant vocalize (r = .00, *ns*) and father-vocalize and infant object play (r = .26, *ns*). Hence father-infant joint action behaviours were not associated with child cognitive development in this sample of well educated middle-class families.

Summary

The findings are based on a small number of studies (n=3) hence should be treated with some caution. Whilst one study found evidence of effect (Tamis LeMonda et al., 2004) the remaining three found no evidence of effect (Magill-Evans et al., 2001, Hunter et al., 1999, Hunter et al., 1987). On balance the results seem to suggest that early paternal sensitivity is probably not associated with cognitive outcomes.

Language development

Four publications measured *language development* (Lindsey et al., 2009; Magill-Evans & Harrison, 1999; Magill-Evans & Harrison, 2001; Tamis-LeMonda et al., 2004).

Magill-Evans et al., (1999)[5] examined language development in 49 healthy and 54 full-term infants at 18 months who were observed interacting with their fathers at 3 months. Interactions were measured using the NCATS, a standardised teaching task administered over 5-10 minutes. Paternal behaviours were coded for sensitivity, responsiveness and stimulation. The Sequenced Inventory of Communication Development- R (SICD-R, Hedrick et al., 1984) assessed receptive language abilities *(awareness, discrimination and understanding)* and the MacArthur Communicative Development Inventory (MCDI, Fenson et al., 1991) measured expressive language *(use of words and complexity of the child's language).* For each outcome, regression analyses was conducted in two stages; first to identify whether paternal interactions independently predicted language development, second, to identify predictors across multiple categories (paternal interactions, child variables and socio-economic status). Results suggest that paternal interactions at 3 months predicted child's receptive language at 18 months in step one and remained a significant predictor in the presence of other variables ($\beta = .19$, $p < .05$). Paternal interactions did not predict expressive language.

Magill-Evans et al., (2001)[6] studied the association between paternal interactions at 3 and 12 months and language development at 48 months using the same study

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[5] The study reports multiple outcomes. The methodology has been described in an earlier section p. 52

[6] The study reports multiple outcomes. The methodology has been described in an earlier section p. 52

described above. The Clinical Evaluation Language Fundamentals – Preschool (CELF- P, Wiig et al., 1992) measured receptive *(linguistic concepts)* and expressive language *(recalling sentence concepts)*. Paternal interactions at 12 months were significant predictors of expressive language skills (figures not reported) and remained a significant predictor in the hierarchical analysis ($\beta = .23$, $p \leq .05$). Father's behaviour in interaction with his child did not predict infant receptive language in the preliminary regression analysis.

Tamis-LeMonda et al., (2004)[7] examined receptive vocabulary development at 36 months in relation to paternal sensitivity during play at 24 months. Language ability was assessed using the Peabody Picture Vocabulary Test (PPVT-III; Dunn and Dunn, 1997). Results suggest associations between receptive vocabulary and dimensions of fathering comprising; sensitivity ($r = .26$, $p \leq .001$), positive regard ($r = .25$, $p \leq .001$) and cognitive stimulation ($r = .25$, $p \leq .001$). Father's supportive parenting (a sum of sensitivity, positive regard and cognitive stimulation) predicted outcome independently of maternal influence ($\beta = .25$, $p \leq .01$).

Lindsey et al., (2009) researched father-child synchrony at 18 months and its link to the child's 'communicative competence' at 36 months, in a sample of 80 father-infant dyads. Components of father-child synchrony coded from a laboratory based semi-structured play activity included; (i) Dyadic reciprocity *(mutual focus, reciprocity and responsive behavioural exchanges)*, (ii) Dyadic emotional expressiveness including; shared positive affect *(smiling, laughter, positive expressions)* and shared negative emotion *(anger, sadness, sarcasm)*, (iii) mutual

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[7] The study reports multiple outcomes. The methodology has been described in an earlier section p. 51

initiation *(initiate play or non-play behaviours and influence the behaviour of the partner)* and (iv) mutual compliance *(follows through the partners communicative attempt or following through the behaviour whilst elaborating on or offering an alternative behaviour).* Language development was assessed using the Reynell Development Language Scales (RDLS; Reynell, 1990). Findings from bivariate correlations suggest that receptive language skills (i.e. verbal comprehension) was associated with early dyadic reciprocity ($r = .31$, $p < .01$) and shared positive effect ($r = .25$, $p < .01$), whilst receptive language development was associated with mutual compliance ($r = .33$, $p < .01$). Results indicate the independent contributions of dyadic reciprocity ($\beta = .25$, $p < .05$) and mutual compliance ($\beta = .36$, $p < .01$) to children's verbal comprehension, whilst dyadic reciprocity ($\beta = .21$, $p < .05$) and shared positive emotions ($\beta = .34$, $p < .05$) made independent contributions to the child's expressive vocabulary.

Summary

Overall the four studies show a fairly consistent association between early interactive behaviours and language use across the first four years of development. These findings were evident despite diversity in methodology including; (i) the sampled population (healthy term infants: Lindsey et al., 2009, healthy pre-term and term infants: Magill-Evans et al., 1999 and low-income families, Tamis-LeMonda et al., 2004), (ii) measures of interaction and different methods applied to calculate dimensions of paternal behaviour (laboratory based semi-structured play activity: Lindsey et al., 2009, teaching a standard task, NCATS: Magill-Evans et al., 1999 and semi-structured free-play using a different set of toys: Tamis-LeMonda et al., 2004) and (iii) age of assessment of language skills (36 months: Lindsey et al., 2009, 18 months: Magill-Evans et al., 1999 and 48 months Magill-Evans et al.,2001).

2.5.5.3 Other outcomes

Other outcomes linked to paternal sensitivity described in appendix 2F,p.348 include: attachment representation (Grossmann et al., 2002), self-regulation (G. Kochanska, Aksan, Prisco, & Adams, 2008; Lindsey et al., 2009), inhibited behaviour (J. Belsky et al., 1998), false-belief understanding and relationship with peers (McElwain & Volling, 2004), internalization of parental rules (G. Kochanska et al., 2008) and self-recognition (Borke, Lamm, Eickhorst, & Keller, 2007). Paternal sensitivity was associated with, attachment representation in 10 and 16 year old children and in self-regulation and the understanding of false belief in early childhood.

2.6 Discussion

The principal goal of the present study was to examine the relationship between observed paternal sensitivity during father-infant interactions across the first two years and children's development measured prospectively. To our knowledge this is the first attempt to systematically report on studies examining the father's direct contribution to his child's behavioural, cognitive and linguistic functioning; using observational measures of paternal sensitivity in the first two years post-birth. The findings suggest that: (i) there are very few studies (n=11) conducted on this research question, (ii) the evidence on the association between early interactions and externalizing behaviours in early childhood is inconclusive but suggests a moderate association, (iii) similarly the relationship between early sensitivity and cognitive

development remains inconclusive due to the presence of mixed results and heterogeneity in methodology and finally (iii) paternal sensitivity was consistently associated with language development in toddlerhood and the pre-school years.

2.6.1 Paternal sensitivity and behavioural development

The finding that paternal sensitivity measured in the first two years was not a consistent predictor of behaviour problems in early childhood does fit with earlier meta-analytic findings of cross-sectional studies between parental care-giving *(acceptance-responsiveness)* and child externalizing behaviours (Rothbaum & Weisz, 1994). In their study, Rothbaum and Weisz found that stronger associations between parenting and child externalizing were reported for older children and adolescents rather than toddlers and preschoolers and for maternal rather than paternal interactions; the 'mean effect size for mothers and fathers were .30 and .21 respectively and the mean percentages of significant effects were 63 and 36 respectively, t (14) = 2.88, p< .05' (p.63).

Similar findings were reported by (Gadeyne, Ghesquire, & Onghena, 2004) who found higher correlations between parenting and child externalizing problems in mothers compared to fathers and in an earlier longitudinal study by Kagan and Moss, (1962) who report stronger associations with increasing age (3-6 and 10-14 years). This is in contrast to studies from the maternal literature which highlight the longitudinal influence of early positive parenting on the development of behaviour difficulties in toddler and pre-school years (G. Kochanska & Aksan, 1995; Pettit & Bates, 1989; Shaw, Keenan, & Vodra, 1994) and to a longitudinal investigation of paternal behaviours at 4 years predicting problem behaviours in six year olds (Cowan, Cowan, Cohn, & Pearson, 1996).

It may be that early disruptions in the father-child relationship exert their influence during later childhood and adolescence rather than in the pre-school years. Support for this view is provided by the following researchers: Cowan et al., (1996) in their measurement of outcome in six year old children, Loeber and Stouthamer-Loeber (1986) in their meta-analysis of care giving and delinquency in older children and adolescents and Stevenson and Black (1988) indicating that father absence accompanied aggressiveness in older boys but not pre-schoolers.

One explanation is provided by the work of Sroufe et al., (1990) on the continued impact of early experience on later development. The impact of paternal sensitivity may not be evident in the early years of development and as such earlier patterns of interaction may remain dormant, only to resurface and manifest in certain contexts, in the face of environmental change or critical time-points in development. Hence we can speculate that father's early interactive behaviours may have a greater impact on behavioural functioning in late childhood and adolescence.

2.6.2 Paternal sensitivity and cognitive-linguistic development

2.6.2.1 Cognitive development

The association between early experiences with fathers and children's cognitive development did not yield conclusive evidence. The one study of positive findings in a sample of low-income fathers (Tamis-LeMonda et al., 2004) suggests moderate associations between paternal sensitivity, positive regard and cognitive stimulation and the children's MDI scores across time. Regression analysis indicated that fathers directly influenced cognitive development independent of demographic variables (employment and education). Although the restricted nature of the sample precludes

broad generalizations, the results are in accordance with other economically disadvantaged samples (M. M. Black et al., 1999; Kelly, Morisset, Barnard, Hammond, & Booth, 1996; Shannon et al., 2002) and with non-disadvantaged participants (Clarke-Stewart, 1978; S. S. Feldman & Wentzel, 1990; Gadeyne et al., 2004; Radin, 1972, 1973).

However the majority of the studies which did not find an association between paternal sensitivity and cognitive development appear to be at odds with those referenced above (Hunter et al., 1987; Magill-Evans & Harrison, 1999; Magill-Evans & Harrison, 2001). There are important methodological aspects which might explain these findings. Hunter et al., (1987) focus on object-directed and vocalization behaviours of fathers and infants. Matched behavioural states, i.e. synchronised turn taking was not originally coded in their data, rather it was computed post-hoc by the amount of time parents and infants engaged in particular shared tasks. This method of computing synchrony and the specific behaviours under consideration may well explain why father-infant interactions yielded no systematic associations with child outcome. Behaviours thought to foster cognitive development include maintaining the child's attentional focus, providing instruction, allowing interactive exchange, responsiveness to child's cues and providing feedback; these may not have been specifically identified within the coding frame. Furthermore the authors indicate that 'joint behaviours occurred rather briefly in the interactions observed' (*p.* 252) which may have had an impact on the overall prediction of outcome.

Magill-Evans et al., (2001) did find an association between paternal interaction and cognitive outcomes in the first stage of their analysis; however the association did not exist when other variables were included. A possible interpretation of the findings could be that paternal behaviours coded using the NCATS, a structured

teaching task may not have been particularly relevant to the prediction of verbal, perceptual-performance and quantitative scales of the McCarthy Scales of Children's development. Alternatively 3 and 12 month interactions may not have tapped into interactive behaviours involving, teaching the child to count, reading to the child and problem solving activities which appear to enhance intellectual performance. Developing more fine-grained categories of behaviours during the teaching task, as a function of the child's specific abilities may likely yield additional information regarding cognitive development. It might also be possible that certain aspects of interactional sensitivity are more or less appropriate at different developmental stages, predicting different outcomes (Tamis-LeMonda et al., 2001).

2.6.2.2 Language development

In the domain of language development, findings from the current research in samples of healthy pre-term and term infants (Magill-Evans & Harrison, 1999), economically disadvantaged infants (Tamis-LeMonda et al., 2004) and normally developing infants (Lindsey et al., 2009) provide support for the importance of sensitivity in predicting the development of expressive and receptive language skills. It is important to note that this association was demonstrated in the assessment of multiple facets of sensitivity; namely 'positive affect, cognitive stimulation and dyadic synchrony. A possible explanation indicates that sensitive interactions facilitate infant attention and positive communication which have been linked to language and communication skills (Gartstein, Crawford, & Robertson, 2008). Vocalizations in the first year after birth are related to the production of language in both normally developing infants (Baumwell et al., 1997) and those with delays (McCathren et al., 1999). Sensitive parenting embedded in the parent's ability to

match or initiate behaviour in accordance to the child's developmental and affective state have also been linked to advances in linguistic ability (Tomasello, 1988). Other researchers have suggested that responsiveness is a significant contributor to the child's linguistic skills (Laucht, Esser, & Schmidt, 2001) and synchronous, coordinated parent-child interactions have also been shown to contribute to the child's early manifestation of attention and language (Isabella, Belsky and von Eye, 1989). Further, evidence also suggests that linguistic competence is related to joint attention (Tomasello & Todd, 1983); if paternal interactions characterised by peaks of arousal and stimulation facilitate high levels of joint attention, fathers are also likely to influence the child's development of words as previously reported in the maternal literature (Baumwell et al., 1997). The above explanations may help in understanding why paternal sensitivity which included the reciprocity of infant behaviours and vocalizations as well as matched vocal exchanges between fathers and their children predicted the development of later language skills. Responsive / sensitive fathers are attentive to more subtle infant cues and may help to orient the infant's attention to stimuli supporting attentional skills and subsequent development of language.

These results appear to be relevant for the developmental period of toddlerhood and pre-school when children rely on their parents emotional and reciprocal signals to communicate their intentions. Whether early paternal behaviours continue to exert an influence on the child's later language skills is unknown. It does appear important to include the prediction of timing in children's developmental outcomes and the constellation of behaviours in fathers that relate to sensitivity and account for the differences in how father-child and mother-child interactions relate to adjustment. Generally findings in the language domain in the context of fathers seem to parallel

those in the maternal literature. The predictive association between early maternal sensitivity and child language development proposes a 'social-interactional view of language in that maternal interactions help to explain language variation in children; language comprehension is facilitated by a language acquisition support system, a sensitive parent' (Baumwell et al., 1997; p. 254).

2.7 Strengths and Limitations

This is the first study to combine findings from longitudinal studies on the father's role in their children's development in a systematic way. A major strength of the study is the inclusion of longitudinal studies that allow an exploration of how early interactive sensitivity influences subsequent child development. In addition direct observations of father-child interactions offer advantages compared to reliance on parental reports. Moreover, by using an independent measure of observed paternal behaviour and outcome reported by one or both parents the risk of single informant bias is minimized.

These findings must be considered in the light of potential methodology limitations including; the small number of included studies, the range of behaviours chosen for observations and included in the definition of sensitivity, differences in the duration and context of the interactions, in the age at which outcomes were measured and the tools used in their measurement. We did not include articles published in languages other than English; however we tried to include all possible English language articles by using other reviews of the paternal literature, reference lists of publications,

contacting authors and checking relevant dissertations. Studies were conducted in the United States of America, Canada and Germany. It is not known whether fathers from other cultures and settings would have a similar impact on their child's development, hence cross-cultural work may lead researchers to be more aware of alternative behaviours linked to early parenting. Finally, due to practical considerations it was not possible to establish inter-rater reliability on extracted data; however all ambiguous coding were discussed during supervision.

2.8 Directions for future research

Further research with larger sample sizes including the role of moderator variables (for example, year of publication, infant gender, marital functioning, SES) is an important next step. More information on timing might be informative in future reviews by examining associations and testing the time of measurement as a moderator. Future research may require more fine-grained dimensions of father-infant interactions at different ages. It is likely that certain aspects of interactional sensitivity are more or less associated with outcome at different developmental stages. Additionally the child's own early competencies and their impact on paternal behaviours may in themselves have long-term developmental consequences as suggested above and the inclusion of bi-directional models may be informative. Finally, future studies also need to address whether aspects of the social environment interact with the developmental status of the child to influence subsequent development.

2.9 Conclusion

This study aimed to examine the prospective association between observed paternal sensitivity and child outcome. An important finding was the presence of very few studies. The results were most consistently positive for the language domain; whereas for externalizing behaviours the results were inconsistent for early childhood but indicated a possible influence on later development. Findings in the cognitive domain remained inconclusive. The process of systematically reviewing the available literature has enabled an identification of associations of emerging relevance, highlighted the importance of including fathers in research and emphasized the need for future studies to fill the gaps in our current understanding.

Chapter 3: Father-infant interactions in the postnatal period: The influence of paternal depression

3.1 Study rationale

Paternal depression has been associated with adverse child outcomes including, internalizing problems, externalizing difficulties and impaired cognitive and social development (Chapter 1, p. 14). Although depression in new fathers has been less researched than postnatal depression in mothers, there is evidence to suggest links to internalizing and externalizing behaviours and deficits in expressive language.

A potential mechanism of the transmission of risk includes impaired parenting practices such as; a decrease in expressed warmth and an increase in psychological control, may result in conflictual father-child relationships and adverse child outcome (2005). Evidence from chapter 2 indicates that early father-infant interactions impact on child outcome; hence exposure to paternal depression may leave children particularly vulnerable to the impact of negative father-infant interactions.

Examining the influence of paternal depression on father-infant interactions is a crucial and timely undertaking for a number of reasons: (i) based on the limited research available, while new fathers experience depressive symptoms (Areias et al., 1996; Matthey et al., 2000), it is unclear whether paternal depression per se impacts negatively on father-infant interactions as maternal depression does on mother-infant interactions (Jones, Field, Hart, Lundy, & Davalos, 2001; L. Murray, Hipwell, Hooper, Stein, & Cooper, 1996), (ii) infants exposed to dysfunctional maternal affect as early as 3 months, respond in a way similar to that affect (Tronick, 1981); it remains unclear how paternal behaviours may impact the infant's affective display, (iii) the changing role of fathers within the family and less differentiation between

parental functions, points towards increased paternal engagement with the infant; hence paternal pathology could potentially have a negative impact on this process, (iv) face- to face interactions are a key pathway in which behavioural malfunctioning may be transmitted from mother to infant (Cohn et al., 1986) and it remains unclear whether early parenting plays the same role for fathers.

The current study aims to examine the early interactions of depressed and non-depressed father-infant pairs. In the following section literature is reviewed from associated areas within developmental psychopathology which have helped guide the development of the study predictions. This is followed by the study design and methodology, the results and their discussion.

3.2 Introduction

Until recently there has been a relative neglect of the father as a component of the infant's early environment. Few theoretical guidelines are available in the existing paternal literature, on the effects of depression on early father-infant interactions. The available studies provide conflicting evidence and report using diverse methodologies (Chapter 1, p. 17). For these reasons, additional evidence from the following three perspectives was utilized: (i) observational studies of mother-infant interactions, (ii) differential aspects of mother-infant and father-infant interactive behaviours and (iii) depression and interpersonal functioning. This literature is discussed below.

3.2.1 Interactions of postnatally depressed fathers

Empirical evidence on the association between paternal depression and father-infant interactions has been reviewed in Chapter 1. While some studies report no differences between the interactions of depressed and non-depressed fathers others suggest depressed fathers are more likely to be withdrawn, experience difficulty forming a relationship with the child or express increased negativity in comparison to non-depressed fathers. These findings are based on varied methodological aspects including; nature of the samples, the context of interactions and measures used in assessing both interaction and depressive symptoms. Overall, there is inconsistent evidence on the impact of paternal depression on father-infant interactions.

3.2.2 Observational studies of postnatally depressed mothers and their infants

In contrast to the mixed findings regarding the effects of paternal depression on father-child interactions, there is consistent evidence of a link between postnatal depression in mothers and impaired behaviours during face to face mother-infant interactions. The studies discussed below have been instrumental in identifying a range of global maternal and infant behaviours affected by depression. They have utilized observational measures of maternal behaviours in the postnatal period; in both clinical and community samples of varying social adversity.

In a low risk community sample of clinically depressed and non-depressed mothers and their 2 month old infants, Murray and colleagues (1996) used face to face observations to examine the impact of depression on interactive behaviour. Compared to non-depressed mothers, depressed mothers were less sensitively tuned

to their infants. They expressed fewer *affirmations* (i.e. 'empathic responses', including imitating infant behaviour and praising infant actions) and more *negations* (i.e. rejecting responses, including contradictory responses to infant actions and expressions). There were no reported differences in infant behaviours in the two study groups; however correlational data suggested that infants of sensitive mothers were more actively engaged with their mothers. What did emerge was the sudden halt in the activity of infants of depressed mothers; triggered by negative cycles of communication.

Marked impairments in communication between mother and infant have been observed in high risk samples making it challenging to disentangle the effects of depression or severe adversity on maternal and infant behaviours. Stanley, Murray & Stein (2004) have addressed this issue using a relatively low risk community sample of depressed and non depressed women in face to face interactions with their 2 month infants. Two aspects of maternal responsiveness were the focus of examination in this study; (i) *contingent positive maternal responsiveness* i.e. positive maternal behaviours in response to the infant and (ii) *contingent negative maternal responsiveness* i.e. maternal negativity directed at the infant. Depressed mothers were less accepting of their infant's behaviour and less positive in their communication.

In a series of observational studies, on mother-infant face to face interactions Field and colleagues (1984; 1988; 1985) report less optimal mother and infant behaviours for depressed mother-infant dyads. Field (1984) found that depressed mothers showed more negative facial expressions, they vocalised less and spent less time looking at and touching their infants. Depressed and non-depressed mothers differed in their level of affective expression, with depressed mothers displaying consistent

flatness and lack of positive expression. Depressed mothers compared to control mothers were more likely to display anxious or depressed affect, use less stimulation (less game playing and activity), display a flat or tense expression and were less responsive and imitative (T. M. Field et al., 1985). Infants of depressed mothers have also shown behavioural disturbances in relation to the maternal interactive profiles described above. Infants of depressed mothers vocalised less, made fewer positive communicative attempts and were rated as being more static. This 'depressive interactive style' also included, gaze aversion, sluggishness, fussiness and irritability.

Cohn et al., (1986) report variability in maternal behaviours on two overlapping dimensions; positivity (i.e. level of engagement) and intrusiveness (i.e. expressions of anger). In a clinically depressed high risk sample of mothers and their 6-12 month old infants, mother-infant dyads were observed in a 6-minute face to face interaction. In the face to face context four maternal interactive styles were identified: (i) *Disengaged*: 'mothers slouched back in their chairs, turned away from the infant, or spoke to the baby in an expressionless voice with little facial expression', (ii) *mixed*: mothers were motivated to engage with the infant bur were restricted in affect and were not able to play, (iii) *intrusive*: mothers expressed negative affect, engaged in rough movements, poking, and pulling at the infant and (iv) *positive:* depressed mothers in this group displayed positive or neutral affect towards the infant. Infants of depressed mothers were withdrawn and rarely expressed positive affect. Their behaviour varied with the maternal profiles discussed above. Infants of intrusive mothers tended to *look away*, whereas infants of withdrawn mothers showed *protest behaviour*. These findings were subsequently replicated in a low risk sample; 2 months postpartum (Cohn et al., 1990). Depressed mothers showed increased

irritation or intrusiveness during interactions with their infants when compared to non-depressed mothers and this negative affect was strongly related to infant affect.

In summary depressed mothers show two distinct styles of interacting with their infants; (1) *withdrawn* (under stimulation) and (2) *intrusive* (over stimulation). The withdrawn profile includes low levels of vocalisation and tactile stimulation, gaze aversion, unresponsiveness and overall disengaged behaviour; whereas intrusiveness is characterised by rough and rigorous engagement; poking, tickling and tugging behaviours and overall displays of anger and irritation. In the current context we would expect depressed fathers to be withdrawn, based on the above findings in the maternal literature and interpersonal deficits (see below) linked to depression.

3.2.3 Depression and interpersonal functioning

Research suggests that depressed individuals experience interpersonal and communication difficulties (Gotlib, 1992). Coyne's interaction model (1976) and the behavioural theory of Lewinsohn (1980) have provided an understanding of interpersonal disturbances. Coyne's theory focuses on the rejection faced by depressed individuals as a result of their social interactions. The social skills deficit hypothesis, a key postulate of Lewinsohn's theory is referenced to understand interpersonal functioning in the context of depression.

Depression impacts on the behavioural indicators of social skills which include, linguistic behaviour (rate, volume, and pitch), facial expression, gaze, posture and gestures (Segrin, 2000). Evidence suggests that interpersonal difficulties stem from these factors. For example, depressed individuals are less facially animated and their facial expression constitutes corrugated brow, squinting and closed eyes, compared to non-depressed individuals. They tend to, lower their gaze, and engage in less eye

contact and non-verbal gestures that may suggest affirmation and interest in others. Depressed speakers are less clear in their communication; expressing sadness paralinguistically via pitch, rate and intonation of speech. Thus depressed individuals are unable to use certain behaviours to enhance interpersonal contact. Rather, their vocal behaviours prevent discourse interest and liveliness, their facial expression conveys information about negative emotional states and attitudes, their gaze suggests lack of interest and attention and their posture and gesturing skills indicate boredom, less affirmation sadness and disinterest.

Evidence suggests that these difficulties extend to parent-child communication. (Hammen et al., 1987) and may have particularly severe implications in the early postnatal period. During this period the infant's primary source of preverbal communication lies in the parent's skilful use of behavioural indicators of social skills. It is likely that depression in father's during the early postnatal months will affect their ability to use sounds, facial expressions, positive affect and games to structure their communication. Interpersonal difficulties manifesting at a later stage of development may lead to less severe consequences. The child may be capable of understanding the cause of the disruptions, hence being more tolerant and less influenced by the impaired relationship. Conversely, dysfunctional interactions in early infancy are more likely to result in stable patterns of infant social, emotional and psychological dysfunction.

3.2.4 Differential aspects of father-infant and mother-infant interactions

Research suggests that depression may have a differential impact on mothers and fathers (Jacob & Johnson, 2001). A potential reason may be that mothers and fathers interact differentially with their infants. Observational studies on parent-infant interactions in early infancy have examined differences between father-infant and mother-infant play and conclusions were made as early as the 70's that fathers were not simply a replacement for mothers (J. Belsky, 1979; Clarke-Stewart, 1978; M.E Lamb, 1977; Weinraub & Frankel, 1977; M. W Yogman, 1977).

An important question addressed by these earlier studies was, *what play style do fathers engage in?*

Lamb (1977) examined '*play*' (i.e. vocal and physical stimulation) and '*physical contact*' (i.e. holding and raising the infant off the ground) between parents (n=20) and their infants aged 7, 8, 12 and 13 months. His results suggest that infants were more likely to elicit highly positive responses during play with their fathers. Fathers were more likely to hold their infants to play, whereas mothers held their infants for caretaking purposes. These patterns were evident in interactions across the three age ranges.

Weinraub and Frankel (1977) observed 18 month old infants at play with their parents (n= 20) in three different laboratory situations; free-play, departure and separation. In the free-play situation (of relevance to the current investigation), mothers were more likely to vocalize, touch and engage in joint activities, with the infant in close proximity. A different pattern emerged for fathers. Their interaction

style included, 'sitting on the chair and watching as the infant brings him toys' (*p.* 1247), providing direction and support but using minimal vocalizations.

Similar observations, on the structural characteristics of parent-infant interactions were made by Yogman (1977) on five father-infant and mother-infant pairs from the second week to six months post birth. At three months fathers engaged in more 'rhythmic tapping games' (*p.*13) and their stimulating playfulness went through abrupt and sudden peaks of excitement to lows of minimal attention. Mothers engaged in more 'verbal games' and their play sequences were smoothly adjusted and controlled.

Clark-Stewart (1978) studied 14 fathers and mothers interacting with their infants in unstructured and semi-structured situations at 15, 20 and 30 months. Their observations revealed a distinctive paternal play style which involved brief episodes of play and consisted of 'social- physical play rather than intellectual play or interactions with objects' (*p.*470).

Belsky (1979) added to the above evidence on paternal physical play, by studying 40 families during naturally occurring routines at home with 15 month old infants. In spite of the difference in amount of time both parents spent with the child in the day, mothers were more likely to engage in caring and nurturing activities compared to fathers. Although, not reaching statistical significance, fathers were rated higher on *'vigorous motion play'*, suggesting similarities with the *'physical play'* dimension described by Lamb in his study above.

In the following decade predominant types of paternal play and individual differences between parental play styles were explored in a variety of contexts some of which include: (i) engagement in games ('episodes of mutual attention in which

the adult uses a repeating set of behaviours') with 1-6 month old infants (M. W. Yogman, 1981), (ii) guided exploration of objects during play with 8-month old infants (Power & Parke, 1983), (iii) socially mediated sensory-stimulation and teaching-oriented attention focusing activities with infants 6 and 12 months old (Yarrow et al., 1984), (iv) relationship and reciprocity effects with 12 month old infants (Stevenson, Leavitt, Thompson, & Roach, 1988) and (v) in day to day activities at home (J. Belsky, Gilstrap et al., 1984; Power, 1985).

The above studies indicate that fathers not only used more 'tactile, limb movement games', as opposed to mothers who utilize 'visual and conventional games such as peek- a- boo' but their interactive games aroused the infant. It thus appears that this highly stimulating play style may be particularly relevant to fathers in the context of physicality. In the context of toy play interactions, data suggests differences based on infant cues. Mothers more likely to follow their infant's attention and focus whereas fathers appear directive, interfering with ongoing infant behaviour.

In summary, most of the studies reviewed have described father-infant interactions as physically stimulating and highly rousing i.e. 'rough and tumble play'. The trajectory of these episodes includes a rapid rise and decline of emotional excitement. In contrast mother-infant interactions are described as 'social play'; smoothly adapted episodes of reciprocity of gaze, vocalisations, positive affect and contained arousal. These differences are illustrated in the two segments of interaction from a video clip of a family (8493) participating in the Oxford Fathers Project *(Appendix 3A, p.352)*.

3.3 Aims and hypotheses

This investigation aims to examine the influence of depression on the interactive behaviours of fathers and their 3 month old infants. The following research questions are addressed.

Research question 1

Are there differences in the behaviours of depressed and non-depressed *fathers* during face to face interactions with their 3-month old infants?

Hypothesis 1: Depressed fathers will be less *sensitive* towards their infants compared to non-depressed fathers.

Hypothesis 2: Depressed fathers will display expressions of *negative affect* with their infants compared to non-depressed fathers.

Hypothesis 3: Depressed fathers compared to non-depressed fathers will display a *'withdrawn'* interactive style, characterised by both physical and psychological detachment; evident through remoteness, silence, lack of energy and responsiveness.

Research question 2

Do *infants* of depressed fathers experience behavioural disturbances during face to face interactions?

Hypothesis 1: Infants of depressed fathers will present *'depressed behaviour'* compared to infants of non-depressed fathers. They will be inattentive, fretful and engage in fewer episodes of positive communication.

3.4 Method

The Oxford Fathers Project[8] (OFP) is a prospective longitudinal study, examining two groups of fathers (one group of fathers with depression and another one without depression) and their infants (N=192). The OFP involves three assessment points (at three, twelve and twenty four months post birth); at which detailed observational measures of parent-child interaction and other assessments of family functioning are undertaken, in addition to an assessment of the child's behavioural, emotional and cognitive development at 24 months. Data for this chapter includes the three month stage.

3.4.1 Participants

Recruitment and selection *(Appendix 3B, p.353)*

4106 fathers and their infants were recruited from the maternity wards of the John Radcliffe Hospital (Oxfordshire) and the Milton Keynes General Hospital (Buckinghamshire) between July 2006 and August 2008. Both parents provided us with their consent and contact details to be contacted 7-weeks post-birth *(Appendix 3C, p.354).* Inclusion criteria included: fathers aged 18 years and older, married, cohabiting or having frequent contact with their infant; multiple births; infants of

[8] Ethical approval was received from the Oxfordshire Research Ethics Committee A (06/Q1604/63).

gestational age >36 weeks, birth weight ≥ 2 Kg and healthy postnatally with no major congenital anomalies or admission to the Special Care Baby Unit (SCBU).

Those who agreed participation were screened for depression at 7-weeks using a postal questionnaire. 1562 of the 1406 families (38%) approached, responded to the screener. All fathers who scored ≥ 10 (n=199) on the EPDS were offered a 3-month assessment. 73 fathers agreed to participate in the 3-month stage. Of those scoring < 10 on the EPDS (n=1335), a random sample of 266 fathers were selected for a 3-month assessment by means of a random number chart. 118 fathers agreed participation at three months[9]. A total sample of 192[10] fathers constitutes the sample of the Oxford Fathers Project.

Demographic description *(Appendix 3D, p.356)*

The sample for this study (n=118) had a mean age of 34.83 years, (*SD*= 6.07, range 19-55); were 92.3 % White; and well educated (2.5 % without school qualifications, 39.8% having achieved a school degree or diploma and 57.7% having qualified with a degree or postgraduate qualification). 78.8 % of the fathers were married and 20.3% were living with their partner. 92.2% of fathers reported that English was their first language; the remaining 7.8% of fathers were bi-lingual. Of the infants, 55.9% were female and 60.2% were first born.

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[9] Analysis on attrition through the study stages is presented on p. 95

[10] The EPDS for one father was not available at seven weeks and hence the numbers do not tally.

3.4.2 Procedure

3-month home assessment

Assessments were conducted at home when the infants were 3-months old. Scheduling of assessments took into account paternal availability and the infant's eating and sleeping patterns. Hence the majority of assessments took place during the weekend. The 3-month assessment included: (i) observational sessions of parent-infant interactions, (ii) the completion of a questionnaire booklet, (iii) a detailed interview to identify participants with symptoms that met the DSM-IV criteria for Major Depressive Disorder and other comorbid psychopathology.

The entire assessment averaged an hour and a quarter and if either parent fulfilled criteria for major depression, their GP was subsequently informed.

Determination of case status

Participant case status was determined from a clinical diagnosis of depression using the Structured Clinical Interview for DSM–IV (SCID; M. B. First, Gibbon, Spitzer, & Williams, 2002b). At 3-months the final sample (n=118) used in the current study comprised: (1) non-depressed fathers (n=99); scoring < 10 on the Edinburgh Postnatal Depression Scale (EPDS) with no current or past diagnosis of Major Depressive Disorder (MDD) and (ii) currently depressed fathers (n=19) with current MDD. The two study groups did not differ on demographic variables examined (*p*.94).

Additional groupings on the OFP included fathers who scored ≥ 10 on the EPDS with no current or past MDD (n=38) and those with past symptoms of depression (n=34). The latter two groups were not included in the current analyses.

Observational assessments

Father-infant face to face interactions were video-taped in two different contexts when the father was seated opposite; (i) the infant placed in an infant seat on a table i.e. the car seat context, (ii) the infant placed in a supine position on a floor mat i.e. the floor mat context; the latter more likely to illicit specific paternal interactive behaviours and differences in infant affect and communication tendencies. Whenever possible both parents were observed with their infants on the same day and during each parent-infant interaction, the other parent left the room and did not observe their partner's behaviour. Parents were instructed to play with and talk to their infant as they would normally do without the use of toys. Each session lasted 3-minutes and observations were counterbalanced for parental gender *(Table 3.1, p. 82)*. The coding of three minutes of face to face interactions has been used sufficiently in previous studies (R. Feldman, Greenbaum, & Yirmiya, 1999; T. M. Field, 1978; T. M. Field et al., 1999b).

Infant distress when placed in the infant seat led to the interaction being stopped if the researcher judged the crying infant did not settle or if the parent asked for the interaction to be stopped. Observations were rescheduled for (n=13), 6.77% of the sample. Details of the set up and the instructions for the sessions are presented in Appendix 3E, p.357.

Table 3.1 Interaction formats applied in the context of counterbalancing for parental gender*

A	B
1. Father Infant car seat	1. Mother Infant car seat
2. Mother Infant car seat	2. Father Infant car seat
3. Mother infant floor mat	3. Father infant floor mat
4. Father infant floor mat	4. Mother infant floor mat

**Note:* This study examines paternal data only

3.4.3 Measures

Seven week screener for depressive symptoms: The Edinburgh Postnatal Depression Scale (EPDS, J. L. Cox, Holden, & Sagovsky, 1987a)

The EPDS is a 10-item self-report scale assessing the symptoms of depression in the postnatal period *(Appendix 3F, p.361)*. The scale rates the intensity of depressive symptoms within the previous seven days. Items are scored on a four-point scale (0-3); with a minimum total score of 0 and a maximum of 30. Eight of the items refer to depressive symptoms (for example, feeling sad and miserable, self-harm) and two endorse symptoms of anxiety (for example, feeling anxious and worried and feeling scared and panicky). We administered the EPDS to screen for depression 7-weeks post-birth for several reasons: (i) the scale takes less than 5-minutes to complete and score; (ii) previous research has suggested it has been easy to use and acceptable to research participants in the community (J.L. Cox, Chapman, Murray, & Jones, 1996), (iii) the scale is reliable and valid for use with men, (iv) it is a widely used measure and the psychometric properties of its use as a screening tool have been studied across different countries (Areias et al., 1996; Carpiniello, Pariante, Serri,

Costa, & Carta, 1997; Ghubash, Abou-Saleh, & Daradkeh, 1997; Lee et al., 1998; Wickberg & Hwang, 1996), (v) the EPDS has been used extensively in both clinical practice (Glaze and Cox, 1991, Schaper et al., 1994) and as a first stage in research into various aspects of PND (Zelkowitz & Milet, 1995) (Zelkowitz and Milet, 1995, Lee et al., 1997) and finally (vi) the scale covers the common symptoms of depression and excludes somatic symptoms such as (sleep and appetite disturbances), concentration difficulties and changes in libido which may be common in the postnatal period.

The EPDS has been validated in men (Matthey, Barnett, & Kavanagh, 2001). Estimates of sensitivity range from 71%-86% and specificities range from 75%-94% (Deater-Deckard et al., 1998; Matthey et al., 2001). Matthey et al report an optimum cut-off score for men on the EPDS as 9/10, for depressive symptoms alone and when anxiety symptoms are included the cut-off is reduced to 5/6. We choose scores of ≥ 10 to define fathers as *'High scorers'* for depressive symptoms alone and those with a score of <10 as *'Low scorers'*.

Three month measures

Demographic information

Fathers provided us with information on paternal language used with the infant, ethnicity, highest educational qualification, employment status, job details and marital status *(Appendix 3G, p.362)*.

Current depression: The Structured Clinical Interview for DSM-1V Axis 1 Disorders (SCID; M. B. First et al., 2002b)

Fathers were interviewed using a semi-structured interview the SCID; for making the DSM-IV diagnosis for major depressive disorder and anxiety disorders[11]. Formal diagnostic criteria are embedded in the context of the SCID (for example, two weeks of mood disturbance and at least five depressive symptoms for the diagnosis of major depression) thus allowing for direct questions and clarifications. The section for the disorder begins with a few essential criteria for the disorder, a categorical system for rating symptoms and continues with questions and prompts to determine if criteria are met to warrant a diagnosis. The SCID has been found to yield high reliability (Segal, Hersen and Van Hasselt, 1994) and evidence suggests that it can reliably differentiate between major depressive disorder and generalized anxiety disorder (Riskind, Beck et al., 1987). Numerous studies have used the SCID to select or describe their study samples (Williams et al., 1992); it has been used in different cultural settings (Sharifi et al., 2009, Del-Ben et al., 1996) and in the diagnosis of depression postnatally (Gorman et al., 2004, Wenzel et al., 2001).

Father-infant interactions: The Global Rating Scales for Mother-Infant Interaction (GRS, L. Murray, Fiori-Cowley et al., 1996)

The GRS were developed to examine differences in the interactions of postnatally depressed and non-depressed mothers-infant pairs. The scales are reliable and Murray et al have reported differences in maternal 'sensitivity' in their low risk sample which have been similar to findings from research on high risk groups (Cohn

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[11] In the current study we have not included anxiety disorders.

et al., 1986; T. M. Field, 1995a). The scales have good discriminant validity for a number of clinical groups such as depression, schizophrenia, borderline personality disorder and differing degrees of social adversity (Crandell, Patrick, & Hobson, 2003; Gunning, Murray, & Lawson, 2002; Riordan, Appleby, & Faragher, 1999). The scales have also been applied cross-culturally in studies in Africa, Japan and Venezuela and across Europe (Cooper et al., 1999; Gunning et al., 2004). Maternal and infant ratings have also been shown to predict later infant (18 months) and child (5 years) cognitive development (L. Murray, Fiori-Cowley et al., 1996; L. Murray, Hipwell et al., 1996).

The instrument to our knowledge has not been used previously with fathers. It was chosen since it has shown to discriminate between depressed and non-depressed women, in a low-risk community sample in the early postnatal period and it is not overly time-consuming in providing a detailed examination of global parental and infant behaviours. The Winnicott Research Unit trained us in the use of the GRS and allowed for several discussions particularly with regards to the current sample of fathers to establish satisfactory reliability between coders.

The Global Ratings are a video-based assessment where the father and infant interact face to face. Thirteen items of paternal behaviour, seven items of infant behaviour and five items of the dyadic interaction between the pair are scored on a 5-point rating scale from 1 (poor) to 5 (good) *(Appendix 3H, p.363)*. Individual items are subsequently clustered to form four paternal dimensions, three infant dimensions and a final dimension assessing the overall quality of the interaction between father and infant *(Appendix 3I, p.364)*. A mean score is calculated for the items which describe the individual dimensions with a possible range from 1-5.

Paternal dimensions were the following: (i) **Good-Poor**; this dimension tapped into paternal sensitivity, and measured the quality of paternal interaction, defined as the extent to which the father responded to the infant's behavioural, motor and emotional cues, expressions of warmth and an adjustment of behaviour to tap into the infant's needs and experiences, (ii) **Intrusive;** paternal behaviours defined under this dimension included vocal or action behaviours, which cut across infant activity, (iii) **Remote;** behaviours under this dimension included paternal withdrawal and disengagement, failing to respond to the infant's activity and (iv) **Depressive behaviour;** the dimension was defined as displays of sad affect and anxious vocal and physical activity.

Infant dimensions were the following: (i) **Good-Poor**; this dimension tapped into the quality of infant behaviours, described as active communication to no communication. Included were ratings of attentiveness, positive vocalisations, and active communication through emotions, pre-speech movements and motor movements, (ii) **Inert;** this dimension assessed the extent to which the infant moved around in the infant chair or on the floor mat and (iii) **Fretful;** this dimension included ratings for infant affect and expressions of irritability and discontentment.

The **Interaction** dimension described the overall nature of interaction between the father and infant and was defined by an average of the following five items: smooth-easy vs. difficult, fun vs. serious, mutually satisfying vs. unsatisfying, much engagement vs. no engagement and excited engagement vs. quiet engagement.

3.4.4 Coding father-infant interactions

The following considerations were made in coding father-infant interactions: (i) where possible the first three-minutes of uninterrupted play were coded, (ii)

coders were blind to paternal case status; (iii) individual coders coded either paternal scales or infant and interaction scales of the GRS, to eliminate a potential source of bias in coding and finally (iv) when one coder was working on the videotapes alone a minimum of 4 weeks were allowed between coding paternal scales and the infant and interaction scales. This procedure allowed for an independent observation of behaviours; thus ratings assigned to one member of the dyad (for example, the paternal scales) did not influence subsequent ratings of the infant and interaction scales.

Data on 225 interactions in the two study contexts (car-seat context = 118; floor mat context = 107) was coded by coder-1 (VS). Three additional coders (placement students on the OFP) were trained in using the GRS by VS. Coder -2 (AK) coded 40 infant or paternal scales of the car seat context. Coders 3 (NS) and 4 (NH) coded a total of 28 interactions in each context. Reliability was established on a sample of 20% of the data (n=45).

3.4.4.1 Inter-rater reliability

In order to establish agreement between coders on the GRS the weighted kappa statistic was used. This statistic was used because the GRS scale is a multicategory ordinal scale; scores ranging from 1-5. The weighted Kappa (Cohen, 1960, 1968) enabled the hierarchical nature of the categories (for example; 1= lack of sensitivity, 3=average and 5=highly sensitive parent) to be retained. Weighted Kappa coefficients tend to be affected by the number of categories and hence the type of weighting scheme employed may impact on the agreement level (Sim & Wright, 2005). In the current study linear weights were employed due to the presence of five categories and evidence to suggest that variation of the quadratically weighted kappa

'appears to be strongest in the range of 2-5 categories' (Brenner & Kliebsch, 1996; p.201). Thus linear weights may potentially offer a more reliable estimate of agreement in comparison to 'quadratically weighted' kappa coefficients.

The strength of the agreement for the kappa coefficient (on individual father, infant and interactions scales) was interpreted using guidelines by Landis and Koch (1977; see table 3.2 below). Similar standards exist with slightly different category descriptions (Shrout, 1998).

Table 3.2 Interpretation of the Kappa coefficient (Adapted from Viera & Garrett, 2005)

	Poor	Slight	Fair	Moderate	Substantial	Almost perfect
Kappa (k)	0.00	.20	.40	.60	.80	1.0

Kappa	**Agreement**
≤ 0	poor
.01-.20	slight
.21-.40	fair
.41-.60	moderate
.61-.80	substantial
.81-1	almost perfect

Overall agreement on the three major GRS dimensions were as follows: (i) Father scales, $k_w = 0.81$; Infant scales, $k_w = 0.83$ and Interaction scales, $k_w = 0.81$

Kappa coefficients for individual subscales of the three main GRS dimensions are presented in tables 3.3-3.5, pp 89-90.

Table 3.3 Measurement of agreement on the Father scales of the GRS (n=45)

GRS Father Scales	Weighted kappa	*SE*	95% CI
Warm	0.83	0.09	0.69-1.0
Accepting	0.76	0.10	0.53-0.84
Responsive	0.82	0.08	0.64-0.99
Non-demanding	0.87	0.08	0.79-0.92
Sensitive	0.81	0.11	0.62-0.93
Non-intrusive behaviour	0.82	0.10	0.65-0.83
Non-intrusive speech	0.88	0.09	0.72-0.99
Non-remote	0.85	0.09	0.69-0.92
Non-silent	0.78	0.14	0.65-0.94
Happy	0.74	0.10	0.64-0.93
Energetic	0.77	0.09	0.62-0.82
Absorbed in the infant	0.78	0.12	0.52-0.89
Relaxed	0.83	0.11	0.78-0.92
Overall agreement	0.81	0.09	

Note: SE= Standard Error, CI = Confidence Interval; Kappa calculated with linear weighting

Table 3.4 Measurement of agreement on the *Infant* scales of the GRS (n=45)

GRS Infant Scales	**Weighted kappa**	***SE***	**95% CI**
Attentive	0.85	0.06	0.73-0.97
Communicative	0.86	0.09	0.64-0.97
Vocalizations	0.80	0.08	0.50-0.83
Engaged	0.81	0.12	0.67-0.92
Lively	0.79	0.07	0.57-0.86
Happy	0.72	0.09	0.54-0.89
Non-fretful	0.83	0.14	0.62-0.97
Overall agreement	0.83	0.09	

Note: SE= Standard Error, CI = Confidence Interval; Kappa calculated with linear weighting

Table 3.5 Measurement of agreement on the Interaction scales of the GRS (n= 45)

GRS Interaction Scales	**Weighted kappa**	***SE***	**95% CI**
Mutually satisfying	0.73	0.06	0.53-0.80
Fun	0.90	0.09	0.76-0.95
Much engagement	0.75	0.07	0.69-0.90
Smooth	0.82	0.13	0.56-0.96
Excited	0.84	0.09	0.62-0.87
Overall agreement	0.81	0.08	

Note: SE= Standard Error, CI = Confidence Interval; Kappa calculated with linear weighting

3.4.5 Power calculations

Power calculations were based on a sample of 50 depressed and 100 non-depressed participants. There were limited studies on which to base an estimate of power for the current investigation. A moderately large effect size of 0.6 or greater was

selected, to establish whether there would be a difference substantial enough to be considered clinically significant. In support of this, findings from the Families Children and Child Care Project (S. N. Lewis et al., 2009) have shown a correlation of 0.28 between paternal depression and later father-child interaction difficulties, corresponding to an effect size of 0.6 (standardised difference). Studies with mother-child interaction associated with depression in mothers show a larger effect size of over 1.0 (L. Murray, Fiori-Cowley et al., 1996).

Studies of child outcomes following depression in mothers show effect sizes of 0.75 for later child behaviour (Sinclair & Murray, 1998), and an effect size of approximately 1.0 for later cognitive scores in boys (D. Sharp et al., 1995). To detect an effect size of 0.6, the sample size of 100 non-depressed and 50 depressed, per group would allow for approximately 20% attrition during the study, whilst still providing power in excess of 85% at the significance level of 5% (two-tailed alternatives).

3.5 Analytic Strategy

3.5.1 Preliminary strategy

Differences in the two groups based on demographic indices

Differences in paternal age in depressed and non-depressed fathers were tested using *t*-tests. Chi-square analyses were computed to test group differences in categorical

variables i.e. paternal educational level, socio-economic status (SES), marital status, and infant's birth order.

Analyzing attrition at 7-weeks and 3-months

Differences between responders and non-responders at 7-weeks were tested using *t*-tests and chi-square analyses for paternal age and infant's birth order and paternal presence at the time of recruitment respectively. Differences between assessed and non-assessed fathers who scored ≥ 10 and those who scored < 10 were also examined for paternal age and SES.

3.5.2 Main strategy

The main analytic plan for this chapter is split into three sections; (a) factor analyses on father, infant and interaction items of the GRS in each interactive context, (b) analyses conducted on interactions in the car seat context and (c) a similar set of analyses on the floor-mat setting.

3.5.2.1 Factor analyses plan[12]

The factor analytic method is described in Appendix 3J, p.365. During the analytic process; preliminary considerations made (data screening and the sample size) and procedures and decisions implemented (choice of factor model, number of factors, factor rotation and the interpretation of factors and factor scores) are detailed in Appendix 3J, p.365.

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[12] Factor analysis was carried out on all entire OFP sample (N= 184).

3.5.2.2 Car seat analytic plan

The analyses were conducted on: (a) groupings obtained by summing scores according to the GRS manual and (b) on the factor structure of the GRS scales.

Exploring data

We used descriptive statistics and box-plots to further explore the distribution of variables.

Bivariate correlations between individual father, infant and interaction items of the GRS

Bivariate correlations were examined to test for associations between the GRS items.

Differences between depressed and non-depressed father-infant interactions using a categorical measure of depression (SCID)

First, differences in the interactions of depressed and non-depressed fathers were tested on major dimension groupings of the GRS using the Mann-Whitney test; a non-parametric equivalent of the independent *t*-test. Next differences in the two study groups were examined based on the factor analyzed groupings. Using regression analyses the effects of paternal age and education were controlled for the above analyses. These characteristics were statistically controlled for, as evidence suggests that paternal education impacts on involvement with the child (Shannon et al., 2006) and that older fathers are found to display greater sensitivity in their interactions with their infants than younger fathers (Gavin et al., 2002). SES in fathers, linked to education level has also been associated with paternal warmth (Atzaba-Poria & N., 2008).

Differences between depressed and non-depressed father–infant interactions using a continuous measure of depression (EPDS)

Spearman's correlation coefficient r_s a non-parametric statistic was used to test for a relationship between EPDS scores on (i) the GRS groupings and the (ii) factors obtained.

Gender differences in the interactions of depressed and non-depressed fathers

Gender differences in interaction were analyzed within the GRS major groupings and the factor analyzed scores using the Mann-Whitney test. Next the differential impact of depression on males and females was tested.

3.5.2.3 Floor mat analytic plan

Data from the floor mat context was analysed using the same steps detailed above for the car seat context.

3.6 Results

3.6.1 Preliminary analyses

Differences in the study groups based on demographic variables

Depressed and non-depressed fathers did not differ on paternal age; t=1.46, p=.146, marital status (χ2 (2) = .56, p= .757), SES (χ2 (2) = 2.83, p= .243) and paternal education (χ2 (2) = 2.13, p= .547). Infant birth order was significantly different in the

two groups ($\chi 2$ (1) = 5.14, p= .023). Based on an odds ratio, infants in the control group were 3.14 times more likely to be first born than latter born.

Analyses of attrition

7-week screener

Fathers who responded to the EPDS were older than those who didn't respond, (*responders*: *M*=34.45, *SD*=5.935, *non-responders*: *M*=31.76, *SD*= 6.39; *p*=.000). There was a significant association between the father's presence or absence on the maternity ward at the time of recruitment and whether or not he responded to the EPDS at 7-weeks ($\chi 2$ (1)= 38.72, p= .000); indicating that fathers who were present were 1.5 times more likely to respond to the EPDS at 7-weeks. There was an association between the first born or latter born child and whether or not the father responded to the EPDS ($\chi 2$ (1) = 21.59, p= .000), the odds ratio suggesting that fathers of first borns were 1.35 times more likely to respond, than fathers of latter born infants.

3-month assessment

Of the fathers who scored ≥ 10 on the EPDS; assessed fathers were older (*M*= 35.36, *SD*=5.87) compared to those who refused participation (*M*=33.01, *SD*=6.87); this difference was statistically significant, *p*=.02. There were no differences on SES (χ^2 (2) = 3.64, p=.162) in fathers who were assessed compared to those who were not assessed. Within the group scoring ≥ 10 on the EPDS (n=199), 126 fathers did not participate in the study. We additionally examined whether this may be accounted for by their EPDS scores, however there were no significant differences in the mean scores on the EPDS between those who participated (*M*=12.87, *SD*= 2.85) and those

who were not assessed (M=12.44, SD= 2.73); p=.287. On examining differences between assessed and non-assessed fathers who scored <10 on the EPDS, there were no significant differences on paternal age (assessed: M=34.63, SD=5.65; not assessed: M=34.67, SD=5.98; p=.954) and SES (χ^2 (2) = 1.78, p=.412).

Of the total sample of fathers who were not assessed (n=274) at 3-months; 79 fathers couldn't be contacted, 41 infants were too old to take part, 6 families had moved home and 118 declined with no further reason.

3.6.2 Main analyses

3.6.2.1 Factor Analyses

The results of the factor analyses are reported first for the car-seat context followed by the factor structure for the floor mat context.

3.6.2.1.1 The car seat context

Factor structure of the ***father scales***: (car seat)

Analysis was conducted on 12 items which constitute paternal behaviour on the GRS. A three factor solution was derived for the sample of 184. The factor loading matrix after rotation is presented below (Table3.6, p. 98). We performed several factor analyses, and considered all solutions before dropping two items *('absorbed in the infant-self-absorbed' and 'relaxed- tense')* from the final solution. Analysis with these items suggested communalities below (.2) and low loadings (<.30) across all three factors. Hence a combination of less variance, low variable communalities and

relatively weak factor loadings on all factors led to a decision to eliminate these items to improve the overall factor solution.

Factor 1 had an eigenvalue of 3.06 and explained 29.85% of the variance after rotation. This factor contained loadings for the following scales; much energy-low energy, non-remote-remote, non-silent-silent and happy-sad. Factor loadings were all above 0.80. We labelled this factor as ***'Engagement'***; defined as the amount of psychological, emotional and verbal energy the father puts into the interaction. It is an indication of the effort, interest and enthusiasm the father experiences in actively engaging the infant.

The second factor ***'Responsiveness' included*** loadings from responsive-unresponsive, non-intrusive speech-intrusive speech and non-intrusive behaviour-intrusive behaviour, scales of the GRS. The latter was associated with the smallest loading (.44) on this factor. The constructs defining this factor included responsiveness, together with assertion of paternal verbal and physical behaviour. This factor had an eigenvalue of 1.68 and explained 16.33% of the variance.

The third factor ***'Sensitivity'*** was defined by loadings for the scales of, accepting-rejecting, warm-positive and non-demanding-demanding. The factor reflects paternal attitude and feelings towards the infant and an understanding and acceptance of the infant's experience. The third factor explained 14.97 % of the variance.

Overall the three factors explain 61.13% of the variation in paternal behaviours during interaction with their infants and identify three meaningful clusters of variables: One corresponding to aspects of effortful interaction, another summarizing responsiveness and a third linked to warmth, understanding and acceptance of infant behaviours.

Table 3.6 Factor loadings for father scales in the car seat context: three-factor solution (N= 184)

	Factor		
Scale	**1 Engagement**	**2 Responsiveness**	**3 Sensitivity**
Much energy	**.87**	-.21	.15
Non-remote	**.87**	.11	-.09
Non-silent	**.85**	.02	-.17
Happy	**.81**	-.16	.26
Responsive	.15	**.85**	.03
Non-intrusive speech	-.21	**.78**	-.04
Non-intrusive behaviour	.08	**.44**	.27
Accepting	.09	.08	**.78**
Warm	.06	-.07	**.71**
Non-demanding	-.06	.14	**.44**

Note: Principal axis factor analysis-Varimax rotation; loadings >.40 are highlighted for the final model

Factor structure of the ***infant scales***: (car seat)

Seven items of infant behaviours from the GRS were analysed. A two factor solution was derived of 184 fathers explaining a total of 72.76 % of the variance. Communality estimates after factor rotations were all above .7. The item *non-fretful-fretful*, had significant loadings (>.4) on each factor. In order to weigh the benefit of reduction in the data against the liability of loss of data about the factors, we decided to retain the item after several examinations. Removing the item led to a significant drop in the variance and the over-all factor solution was less meaningful. Only two items load onto the second factor hence any further analysis would require a caution

in drawing interpretations and in the reliability of the factor. The matrix after rotation is presented below (Table 3.7, p. 100).

The first factor which explained 55.21% of the variance had an eigenvalue of 3.87 and was labelled ***'Positive communication'***. This factor included loadings from the following infant scales; active communication-no active communication, happy-distressed, engaged with the environment-self absorbed, positive vocalisations and attentive-avoidant. Factor 1 was consistent with the infant's attempts of interest and positive communication using vocalisations, contented emotional signals and eye contact.

Factor 2, ***'Reactivity'***, accounted for 17.54% of the variance and had an eigenvalue of 1.22. The factor structure of factor 2 included item loadings from: lively-inert and non-fretful fretful scales. However the latter item cross-loaded onto factor 1 as suggested above. Reactivity was evident in increased activity levels and fretful outbursts; behavioural displays of infant fretfulness.

Table 3.7 Factor loadings for infant scales in the car seat context: two factor solution (N=184)

	Factor	
	1	**2**
Scale	**Positive communication**	**Reactivity**
Active communication	**.90**	.08
Happy	**.86**	-.20
Engaged with the environment	**.85**	-.03
Positive vocalisations	**.79**	.19
Attentive	**.79**	-.03
Lively	.26	**.82**
Non-fretful	**.52**	**-.69***

Note: Principal factor analysis- Varimax rotation; significant loadings >.40 for the final model are highlighted; *negative value suggests that as reactivity increases the rating of non-fretfulness decreases, indicating a reactive, i.e. fretful infant factor.

Factor structure of the ***interaction scales***: (car seat)

In the car seat context one factor labelled, ***'Dyadic Interaction'***, was extracted which explained 84.96% of the variance and had an eigenvalue of 4.25 (Table 3.8, p. 101). For the purpose of consistency we present this factor structure, however with all factor loadings above .9 there is a strong implication that an average of the scores would have similar implications. This factor was a reflection of the overall quality of the interaction, described positively as being fun, with numerous episodes of smiling, vocalisations and exchange of positive affect and displays of infant contentment and engagement.

Table 3.8 Factor loadings for interaction scales in the car seat context: one-factor solution (N= 184)

Scale	Factor 1 Dyadic Interaction
Mutually satisfying	**.95**
Fun	**.93**
Much engagement	**.93**
Excited	**.90**
Smooth	**.90**

Note: Principal axis factor analysis; one factor solution hence no rotation was applied.

3.6.2.1.2 The floor mat context

Factor structure of the ***father scales***: (floor mat)

Analysis was conducted on 12 items indicative of paternal behaviour. A similar item configuration to that used in the car seat context was applied in this context, after item elimination to improve the overall factor solution. The resulting three factor solution (Table 3.9, p. 102) derived for a sample of 178 participants explained a total of 63.88% of the variance in paternal behaviour.

Identical to the car seat context the first factor, ***'Engagement'***, had high loadings (above .8) from the following items; high-low energy, non-remote-remote, non-silent-silent and happy-sad and explained 33.46% of the variance. An eigenvalue of 3.37 was associated with this factor.

Factor 2 (eigenvalue= 1.72) included variables that appear to represent acceptance of the infant and paternal communicative intent. This factor loads heavily (>.8) on the presence of, responsive-unresponsive and non-intrusive –intrusive-speech and less so

for accepting-non-accepting behaviours (.43). Unlike the car seat context the presence of non-intrusive-intrusive behaviour was not associated with this factor. We have labelled this factor ***'Infant directed responsiveness'*** which explains 16.32% of the variance.

Item loadings for factor 3 are different to those obtained for the car seat context. This factor had an eigenvalue of 1.32 and explained 14.10% of the variance. This factor was labelled, ***'Sensitivity'*** as the variables loading on this factor describe, paternal activity around the infant, as well as behaviours expressing warmth and direct paternal communication.

Table 3.9 Factor loading for the father scales in the floor mat context: three factor solution (N=178)

	Factor		
	1	**2**	**3**
Scale	**Engagement**	**Infant-directed responsiveness**	**Sensitivity**
Much energy	**.90**	.01	-.04
Non-remote	**.89**	-.01	.01
Non-silent	**.86**	-.02	.04
Happy	**.83**	.07	.06
Non-intrusive speech	-.31	**.85**	-.09
Responsive	.18	**.85**	.05
Accepting	.15	**.43**	.18
Non-intrusive behaviour	-.22	-.00	**.75**
Warm-Positive	.32	.06	**.63**
Non-demanding	-.02	.00	**.54**

Note: Principal axis factor analysis-Varimax rotation; significant loading >.40 are highlighted

Factor structure of the ***infant scales***: (floor mat)

Initially we examined seven items of infant behaviour. The *'attentive-inattentive'* item had substantially low loadings on both factors (<.2), this item was deleted and the factor analysis was recomputed on the remaining subset of items.

Unlike the car seat context, the first factor in the floor mat context had high loadings for items describing infant affect, including non-fretful-fretful; engaged with the environment-self-absorbed and happy-distressed items. The presence of the lively-inert dimension was not associated with this factor. This factor explained 40.57% of the variance and had an eigenvalue of 3.47. We labelled this factor ***'Positive affect'***. The factor captured the infant's emotional state during the interaction (Table 3.10, p. 104).

The items describing factor 2, correspond to infant communication with primary loadings for infant liveliness, active communication and vocalisations. We labelled this factor ***'Active communication'***, as it described the infant's vocal, motor and facial communication. This factor explained 37.78% of the variance and had an eigenvalue of 1.23. The factor structure of the infant scales thus suggests differences based on both the extracted factors and the loading of individual scales in the car seat and floor mat contexts.

Table 3.10 Factor loadings for infant scales in the floor mat context: two factor solution (N=178)

	Factor	
	1	**2**
Scale	**Positive affect**	**Active communication**
Non-fretful	**.94**	-.02
Engaged with the environment	**.85**	.31
Happy-Distressed	**.74**	**.41**
Lively	-.01	**.89**
Active communication	.46	**.79**
Positive vocalizations	.27	**.78**

Note: Principal factor analysis-Varimax rotation; loadings >.40 are highlighted

Factor structure of the ***interaction scales***: (floor mat)

Similar to the car seat context, one factor labelled, ***'Dyadic Interaction'***, was extracted (Table 3.11) which explained 83.55% of the variance and had an eigenvalue of 4.18. Since only one factor was extracted the Viramax rotation was not applicable.

Table 3.11 Factor loadings for interaction scales in the floor mat context: one-factor solution (N= 178)

Scale	**Factor 1** **Dyadic Interaction**
Mutually satisfying	**.95**
Fun-Serious	**.92**
Much engagement	**.92**
Smooth-Difficult	**.91**
Excited-Quiet engagement	**.87**

Note: Principal axis factor analysis; one factor solution hence no rotation was applied.

3.6.2.2 Car seat context

3.6.2.2.1 Exploring data

Box-plots and histograms of the items of the GRS suggested that data for some variables was not normally distributed. The means and standard deviations for individual items and descriptive statistics based on the two study groups are presented in appendix 3K, p.374.

3.6.2.2.2 Bivariate correlations

Intercorrelations between individual father, infant and interaction items are presented in the appendix 3L, p 375.

3.6.2.2.3 Differences between depressed and non-depressed father-infant interactions using a categorical measure of depression (SCID)

Major dimension groupings of the GRS (Table3.12)

There were no differences in the mean scores on behaviours of depressed and non-depressed fathers and their infants.

Table 3.12 Mean scores for major groupings of the GRS *(Car Seat)*

GRS dimensions	Non-depressed (N=97) Mean *(SD)*	Current depression (N=19) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.62 (.54)	3.47 (.63)	-.87	.385
Intrusive-Remote	-.33 (.66)	-.32 (.59)	-.03	.976
Intrusive Scale	3.88 (.91)	3.97 (.73)	-.19	.847
Remote Scale	4.54 (.84)	4.60 (.81)	-.44	.659
Depressive Scale	3.88 (.59)	3.66 (.69)	-1.17	.242
Infant dimensions				
Good-Poor	2.88 (1.08)	2.74 (1.06)	-.323	.747
Inert-Fretful	-.13 (.38)	-.02 (.48)	-1.13	.257
Inert Scales	3.36 (.87)	3.18 (.97)	-.71	.480
Fretful Scales	3.63 (.90)	3.21 (1.10)	-1.31	.191
Interaction dimension				
Interaction Scale	2.92 (1.09)	2.79 (1.03)	-.34	.731

Note: Higher ratings indicate positive interactions.

Factor analysed scores (Table3.13)

There were no differences in the mean scores on factor analysed groupings of paternal and infant behaviours.

Table 3.13 Mean scores for factor analyzed groupings *(Car Seat)*

Factors	Non-depressed (N=97) Mean *(SD)*	Current depression (N=19) Mean *(SD)*	*Z*	*p*-value
Father				
Engagement	-.02 (-.02)	-.14 (1.01)	-.53	.594
Responsiveness	.03 (1.02)	.17 (.17)	-.49	.625
Sensitivity	.06 (.91)	-.41 (1.30)	-1.28	.201
Infant				
Positive communication	-.03 (1.01)	-.31 (1.09)	-.61	.541
Reactivity *(fretfulness)*	-.03 (.90)	.16 (1.19)	-.88	.379
Interaction				
Dyadic interaction	-.07 (1.01)	-.08 (.89)	-.06	.955

Note: Higher scores indicate increased behaviours represented by the groupings.

3.6.2.2.4 Linear Regressions

After adjusting for covariates (paternal age and education), a significant effect of paternal depression on the '*sensitivity*' factor was found (Table 3.14, p. 108). This suggests the effects of reverse confounding as there were no significant differences in the interactions of depressed and non-depressed fathers reported. Model 2 was significant, F (3, 111) = 2.85, p=.041 and explained 26.7% of the variance. The model suggests that paternal depression significantly predicts paternal sensitivity, *t*

(111) =-2.03, p=.045 whilst controlling for education. The relationship between depression and sensitivity is negative, implying that depressed fathers are less sensitive with their infants (i.e. less accepting of the infant, and expressing less warmth towards the infant). However we must be cautious in our interpretation of this finding, as the current analysis utilized parametric statistics, whereas the original results were based on non-parametric statistics.

There were no reported confounding effects of age and education on the association between depression and the other father and infant interactive behaviours in the car seat context.

Table 3.14 Summary of regression analysis controlling for paternal age and education (N= 116)

Variable	**B**	***SE* B**	**β**	***p***
Step 1				
(Constant)	.06	.10		
Fathers case status *(depressed =1, non-depressed=0)*	-.48	.25	-.18	.055
Step 2				
(Constant)	-.85	.56		
Fathers case status *(depressed =1, non-depressed=0)*	-.50	.25	-.19	.045
Education *(0=No qualification through to 5=postgraduate)*	.12	.06	.17	.061
Age	.02	.02	.09	.332

Note. R^2 =.03 for step 1; ΔR^2= .04 for step 2

3.6.2.2.5 Differences between depressed and non-depressed father-infant interactions using a continuous measure of depression (EPDS)

Major dimension groupings of the GRS (Table 3.15)

EPDS scores were not associated with the major groupings on the GRS.

Table 3.15 Correlations between EPDS scores and GRS summary scores (car seat; n=118)

GRS groupings	r_s	*p*-value
Father dimensions		
Good-Poor	-.15	.116
Intrusive-Remote	.00	.994
Intrusive Scale	-.01	.882
Remote Scale	.01	.926
Depressive Scale	-.08	.396
Infant dimensions		
Good-Poor	.09	.356
Inert-Fretful	.13	.164
Inert Scale	.10	.320
Fretful Scale	-.01	.887
Interaction scales		
Interaction	.07	.445

Factor analysed scores (Table3.16)

EPDS scores were not associated with the factor analysed dimensions in the car seat context. Evidence of a negative association between sensitivity and EPDS scores approached significance (r = -.16, *p*= .087).

Table 3.16 Correlations between EPDS scores and factor scores *(*car seat*; n=118)*

Factors	r_s	*p*-value
Father factors		
Engagement	-.03	.761
Responsiveness	-.05	.626
Sensitivity	-.16	.087
Infant factors		
Positive communication	.07	.427
Reactivity	.14	.129
Interaction factor		
Dyadic interaction	.07	.461

3.6.2.2.6 Differences in the interactions of male and female infants (Car Seat)

Gender differences in interaction across the sample *(Appendix 3M, p.378)*

There were no differences in mean scores on the GRS or the factor analysed dimensions in males and females.

Differential influence of depression by infant gender *(Appendix 3N, p.379)*

There were no reported gender differences across the two study groups using the GRS summary scores or factor analysed scores.

3.6.2.2.7 Summary of results using a categorical measure of depression- Car seat context

GRS summary scores

There were no differences in the interactions of depressed and non-depressed paternal, infant and interactive behaviours using a categorical measure of depression. Similar findings were reported for the interactions of depressed and non-depressed fathers based on infant gender.

Factor analysed dimensions

There were no reported differences on factor analysed dimensions with regards to paternal depression status or infant gender.

3.6.2.2.8 Summary of results using a continuous measure of depression- Car seat context

GRS summary scores and factor analysed dimensions

EPDS scores were not associated with father, infant or interaction scores.

3.6.2.3 Floor mat context

3.6.2.3.1 Exploring data

The means and standard deviations for individual items and descriptive statistics based on the two study groups are presented in appendix 3P, p. 384.

3.6.2.3.2 Bivariate correlations

Correlations between individual items of the father, infant and interactions scales are presented in appendix 30, p.381.

3.6.2.3.3 Differences between depressed and non-depressed father-infant interactions using a categorical measure of depression (SCID)

Major dimension groupings of the GRS (Table 3.13)

There were no differences in the mean scores of depressed and non-depressed father infant pairs on the floor mat.

Table 3.17 Mean scores for major groupings of the GRS *(Floor mat)*

GRS dimensions	Non-depressed (N=90) Mean *(SD)*	Current depression (N=17) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.68 (.54)	3.65 (.61)	-.05	.957
Intrusive-Remote[1]	-.51 (.66)	-.12 (.75)	-1.79	.074
Intrusive Scale	3.58 (.90)	3.97 (.65)	-1.55	.122
Remote Scale	4.60 (.75)	4.20 (1.03)	-1.21	.226
Depressive Scale	4.03 (.53)	3.76 (.56)	-1.60	.111
Infant dimensions				
Good-Poor	3.35 (1.09)	3.47 (1.05)	-.40	.693
Inert-Fretful[2]	.04 (.38)	-.03 (.32)	-.70	.490
Inert Scales	3.94 (.83)	3.88 (1.00)	-.15	.883
Fretful Scales	3.87 (.81)	3.94 (.61)	-.14	.887
Interaction dimension				
Interaction Scale	3.39 (1.06)	3.25 (1.16)	-.48	.634

Note: Higher scores indicate more positive interactions; [1] Scores range from -2 intrusive to +2 remote; [2] Scores range from -2 withdrawn to + 2 fretful.

Factor analysed scores (Table 3.18)

There were no significant differences between depressed and non-depressed fathers on the factor analysed groupings. Difference in mean scores between depressed (M= -.62, *SD*= 1.32) and non-depressed (M= .07, *SD*= .92) fathers on the positive engagement factor approached significance (z = 2.06, p= .053); indicating that depressed fathers were less energetic, and exciting, more withdrawn and contained and more likely to display episodes of negative affect.

Table 3.18 Mean scores for factor analyzed groupings (Floor mat)

Factors	Non-depressed (N=90) Mean *(SD)*	Current depression (N=17) Mean *(SD)*	*Z*	*p*-value
Father				
Engagement	.07 (.92)	-.62 (1.32)	2.06	.053
Infant-directed responsiveness	-.02 (1.06)	-.18 (-.18)	.589	.569
Sensitivity	-.14 (1.02)	.31 (.98)	-1.73	.098
Infant				
Positive affect	-.04 (1.00)	-.06 (1.35)	.09	.930
Active communication	.01 (.10)	-.00 (.76)	.033	.974
Interaction				
Interaction	-.05 (1.00)	-.34 (1.21)	1.04	.302

3.6.2.3.4 Linear Regressions

After adjusting for covariates there were no significant differences in the association of depression and outcomes (GRS summary rating and factor analysed structures) in the floor mat context.

3.6.2.3.5 Differences between depressed and non-depressed father-infant interactions using a continuous measure of depression (EPDS)

Major dimension groupings of the GRS (Table 3.19)

There was a significant positive association between EPDS scores and the intrusive to remote summary score, $r_s = .20$, $p = .044$. Since scores on this dimension indicate -2 (intrusive) to +2 (remote), this association suggests that fathers who reported more symptoms of depression were rated as being remote and withdrawn when interacting with their infants. The association between EPDS and withdrawal was further evident on the remote scale of the GRS, $r_s = -.20$, $p = .045$; implying increased paternal remoteness (lower scores) with increased depression symptoms (high EPDS scores).

Table 3.19 Correlations between EPDS scores and summary scores based on the GRS groupings (floor mat; *n=118)*

GRS groupings	r_s	***p*-value**
Father dimensions		
Good-Poor	.01	.911
Intrusive-Remote	.20	.044
Intrusive Scale	.13	.179
Remote Scale	-.20	.045
Depressive Scale	-.17	.077
Infant dimensions		
Good-Poor	.03	.740
Inert-Fretful	-.10	.352
Inert Scale	.05	.594
Fretful Scale	.06	.507
Interaction scale		
Interaction	.03	.772

Factor analysed scores *(Table 3.20)*

There were no significant associations between the EPDS scores and the factor analysed dimensions of the GRS in the floor mat context. The negative association

between paternal engagement and EPDS approached significance (r = -.19, *p*= .055); less engaging fathers (low scores) had increased depressive symptoms.

Table 3.20 Correlations between EPDS scores and factor scores *(*floor mat*; n=118)*

Factors	r_s	*p*-value
Father factors		
Engagement	-.19	.055
Infant directed responsiveness	.04	.664
Sensitivity	.07	.508
Infant factors		
Positive affect	.07	.454
Active communication	-.00	.971
Interaction factor		
Interaction	-.02	.809

3.6.2.3.6 Differences in the interactions of male and female infants

Gender differences in interactions across the sample *(Appendix 3Q, p.385)*

There were no gender differences in the mean interaction scores based on the GRS groupings and factor analysed dimensions.

Differential influence of depression by infant gender *(Appendix 3R, p.386)*

Female infants of depressed and non-depressed fathers did not differ in their interactive behaviours based on GRS summary scores. There was however; a significant difference (z = -2.09, *p*=.039) on the inert score between depressed (*M*= 4.60, *SD*=0.55) and non-depressed (*M*=, 3.77, *SD*=.86) male infants; indicating that male infants of depressed fathers were livelier.

On the factor analysed scores; the overall interactions of female infants of depressed fathers were less positive (*M*= .70 *SD*= 1.19) compared to female infants of non-depressed fathers (*M*=.04, *SD*=.89); z = -2.05, *p*=.041. There were no reported interaction differences in male infants of depressed and non-depressed fathers on the factor analysed scores

3.6.2.3.7 Summary of results using a categorical measure of depression-floor mat context

GRS summary scores

There were no significant differences in the interactions of depressed and non-depressed father-infant pairs. Using GRS summary scores, female infants of depressed fathers were less active and lively and their overall interaction ratings were less positive.

Factor analysed dimensions

Depressed fathers were more withdrawn during the three minute interaction. Overall dyadic interaction between female infants and depressed fathers was less positive compared to their interactions with male infants.

3.6.2.3.8 Summary of results using a continuous measure of depression-Floor mat context

GRS summary scores

Depressed fathers compared to non-depressed fathers were less intrusive and more remote in their interactions on the floor mat.

Factor analysed dimensions

EPDS scores were not associated with the factor analysed dimensions. The engagement factor showed a weak negative association with EPDS scores and this value approached significance.

3.7 Discussion

This study aimed to examine the interactions of depressed and non-depressed fathers and their 3-month old infants. The main findings in the two interactive contexts were as follows: In the car seat context, paternal depression did not predict worse; *paternal behaviours*, (decreased sensitivity, displays of negative affect and withdrawal), *infant behaviours* (decreased positive communication and displays of negative affect) nor *dyadic behaviours* (overall interactions characterised as being difficult, with fewer episodes of engagement and exchange of positive affect). Similarly in the floor mat context, paternal depression was not associated with the quality of father-infant interactions.

These findings raise an important question which we attempt to address in the discussion below. *Why is paternal depression not associated with reduced quality of father-infant interactions?*

3.7.1 Paternal behaviours

The hypotheses that depressed fathers would be less sensitive, more negative and withdrawn in their interactions compared to non-depressed fathers were not supported.

The findings are consistent with earlier findings by Field et al., (1999b), Lundy (2002b) and Pelchat et al., (2003) in which depressed and non-depressed fathers interacted similarly with their infants. Possible explanations discussed below include: the nature and reporting of depressive symptoms in fathers, sex differences in

response to depression and methodological reasons, for example the measure of interaction used and sample bias.

First, the intensity of the reported depressive symptoms may have contributed to reducing differences between the two study groups. The transient effects of depression postnatally may differ from the effects of more chronic depression. That fathers underreported symptoms of depression (Matthey et al., 2000) or that disturbances in affect were manifested in ways not picked up by either the screener or the clinical interview, may explain our results. Fathers may have felt less able to recognize and articulate symptoms of affective disturbance, since the majority of the sample were older, educated professionals, motivated towards positive parenting. Depression in the postnatal period is an under-researched phenomenon in fathers, compared to the general understanding about maternal depression, which may have contributed to a lack of identification of symptoms by men.

Second it is possible that men are more likely to distract themselves from depressed mood, thereby reducing their symptoms, which could suggest why depressed fathers reported fewer symptoms or were more likely to behave like controls. Nolen-Hoeksema (1991) propose that sex difference in response to depression may explain why women are twice as likely as men to show depression. Another related explanation lies in the literature on sex-role socialization, whereby displays of emotionality or emotional vulnerability is restricted to female children. Restrictions on emotional expression may continue into adulthood and may be particularly evident in the postnatal period when issues regarding evaluation and competence in the paternal role are of significance.

Third, it is possible that the observation itself being a relatively novel experience for fathers may have diminished the effects of depression and instead mobilized their emotion focused coping strategies. It might be that future studies incorporate multiple measures rather than a single measure to be able to reduce the uniqueness afforded by face to face interactions.

Fourth from a methodological standpoint, it is possible that the components of interaction as measured by the GRS were more focused on maternal behaviours and failed to tap into aspects of paternal interactions expressed in infancy and more sensitive to depression. The few studies that report differences in the interactions of depressed and non-depressed fathers have examined behaviours such as tactile stimulation (Zaslow et al., 1985), outdoor play activities (Paulson et al., 2007) and intrusive behaviours in a free-play session (McElwain & Volling, 1999). Perhaps these paternal behaviours are more susceptible to the influence of depression in fathers as opposed to responsiveness, warmth, and more verbal components. Since there was an indication of likely differences in terms of paternal engagement in the floor mat, it might prompt future research to study the floor mat context and code behaviours which are likely to be more prevalent in paternal interactions. Developing father-oriented measures might help to answer some of the existing queries. We address the latter issue in the next chapter.

Finally, with regards to the nature of the sample; the lack of findings in this study could also be linked to the lack of power because of the small group size of currently depressed fathers. Another explanation may be that less than a quarter of the depressed fathers agreed to participate in the study suggesting that the most dysfunctional families did not participate and those families who agreed participation may have more positive interactions. Additionally the demographic characteristics of

the current study participants (the absence of disadvantage i.e. higher educational achievement and SES) may have the potential to protect against the adverse effects of paternal depression. More educated and economically secure fathers are likely to have positive relationships with their infants and are more enthusiastic in providing a stimulating experience (Tamis-LeMonda et al., 2004).

3.7.2 Infant behaviours

The hypothesis that infant's of depressed fathers would display *'depressed behaviour'* was not supported. Similar results have been reported in the maternal literature (Murray et al., 1996). Potential explanations include specific aspects of paternal behaviours for example, peaks of arousal and the possible activation of a compensatory mechanism.

First, paternal playful interactions may have explained why infants of depressed fathers didn't differ from infants of non-depressed fathers. As suggested by Murray et al., (1996) in relation to the maternal literature; a possible explanation for absence of group differences in infant behaviour could be explained by the preservation of certain general features of normal interactions that were adequate to keep the infant engaged in communicative exchange. Related to this explanation are the more specific aspects of paternal play (Power & Parke, 1983). Fathers role in *'directing'* rather than *'facilitating'* play; by means of active, physically arousing bouts in the face of infant disinterest, may help retain infant communication. Furthermore, random displays of positive emotionality in father-infant exchange, used to protect against infant disorganisation may have led to increased synchrony in the expression of positive arousal (R. Feldman, 2003). This pattern of arousal thus involves the father and infant entering into a cycle of engagement and disengagement, whereby

they co- construct, uphold and organise positive affective states in the context of social interactions.

Second, depressed fathers may consider the responsibility for providing an appropriate environment integral to their role as father, thereby activating a '*compensatory*' mechanism, to counteract depressive symptoms. Support for this argument is evident in studies which suggest that non-depressed fathers may compensate for 'depressed' mother-child interactions (Edhborg, Lundh, Seimyr, & Widstrm, 2003; Hossain, Field, Gonzalez, Malphurs, & Valle, 1994). Hence the fathers in this study might compensate the infant for their own depression through a more happy and arousing interaction.

3.7.3 The role of infant gender

Infant gender did not contribute to differences in interactions in the two study groups. This finding lends support to Belsky's (1984) argument that infant characteristics are the least important in determining competent parenting and with other researchers who suggest that in infancy and early childhood child's gender does not influence the quality of parent-child communication (Biringen & Robinson, 1991; Pelchat et al., 2003).

3.8 Strengths and Limitations

The strengths of the study include: (i) the use of observational measures in two different interactive contexts. These home based direct observations are more likely

to provide 'unique information about complex and fast moving processes' (Gardner, 2000, p. 187). By using two different contexts, albeit on the same day there was some indication of stability in observed behaviour and also whether the floor mat context may elicit more specific paternal behaviours, (ii) blind coders to rate paternal and infant behaviours and (iii) the use of a diagnostic interview for measuring depression. Some limitations include: (i) the current findings apply to white middle class families and it remains unclear whether findings are relevant to other socio-economic groups, (ii) in spite of using two different situations the use of multiple measures of father-infant interactions, may be more suitable with fathers to counteract the novelty of an isolated measure and (iii) finally an important limitation and perhaps one to address when designing future research with fathers is the small sample size of depressed fathers.

3.9 Conclusion

This study aimed to examine the early interactions of depressed and non-depressed fathers-infant pairs. Face to face interactions were assessed using the GRS, a well-validated measure widely reported in the maternal literature. Results indicate that depressed and non-depressed fathers and their infants did not differ in their interactive behaviours. However the results raise important issues: (i) the application of the current coding scheme in fathers, (ii) the measurement of distinctive paternal interactive behaviours, (iii) the differential impact of depression on maternal and paternal behaviours and (iv) the context of measuring interactions in fathers.

Chapter 4: Broadening the focus of measurement to include more representative paternal behaviours

4.1 Study rationale

In the previous chapter no differences were found in the interactions of depressed and non-depressed fathers. Several reasons were proposed for this (p. 118) including the possibility of a methodological explanation. It is possible that the current coding scheme (GRS) was not finely tuned to the paternal interactive style; behaviours such as 'vigorous motion play', 'tactile limb movement games' and 'peaks of emotional excitement'. The GRS dimensions may be particularly sensitive to socially mediated sensory stimulation; such as reciprocity of gaze, vocalizations and episodes of contained positive affect and arousal; which are more characteristic of face to face interactions of mothers and their infants.

The goal of the current study is to broaden the focus of measurement of early father-infant interactions; by identifying constructs more characteristic of paternal interactions and related to theories of early parental influence. The development of the Paternal-Physicality Affect and Touch Scale (P-PATS) in the current study will enable a re-examination of paternal behaviours during face to face interactions in depressed and non-depressed fathers and their three months old infants.

This new scale considers: (i) an assessment of behaviours which are related to fathers more specifically and not coded using the GRS, such as tactile stimulation, episodes of excitatory arousal, (ii) the premise that perhaps depression has a differential influence on paternal and maternal interactions, (iii) the context of interactions, i.e. the floor mat context may be particularly informative regarding affective and physically arousing components of the father-infant relationship and might represent more naturalistic play in comparison to the car seat context.

The remainder of this chapter follows the following format: A discussion of the theoretical underpinning of the scales of the P-PATS, followed by a detailed description of their development and implementation. Next, the findings are presented, followed by their discussion and concluding comments.

4.2 Introduction

In this section theoretical and empirical evidence is examined in relation to four key areas, which form the individual sub-scales of the P-PATS; (i) Tactile stimulation, (ii) Affective synchrony: concurrent occurrence of smiles and lead-lag relations, (iii) Physical play, (iv) Excitatory arousal and (v) Active engagement. The following aspects of the literature are included: the expression of each construct in early parent-infant interactions, empirical studies to suggest that depression may impact on their expression and associated child outcomes.

4.2.1 Tactile stimulation

Communication through touch: A neglected modality of communication?

The infant interaction literature has focused primarily on visual, auditory and affective communication; the study of touch remains one of the least researched areas. In early infancy touch facilitates the regulation of arousal, attentiveness and interest; enhances proximity between parent and infant and helps soothe the infant (Koester, Papousek, & Papousek, 1989; Tronick & Cohn, 1989). Touch serves a communicative function signalling emotions of positive (Pelaez-Nogueras et al.,

1996) and negative valence (Hertenstein & Campos, 2001) and the transmission of more specific messages for example, security in the presence of the caregiver (Tronick, 1985).

Hertenstein (2002) defines touch as; (a) 'the action of an object on the skin i.e. *contac*t' and (b) 'the resulting change in the infant's perception, thoughts and feelings as a function of cutaneous stimulation, i.e. *feeling*'. In the current study we focus on *contact* which is referred to as tactile stimulation. The examination of infant self-regulation in response to paternal touch is beyond the scope of the current investigation.

Is there evidence to suggest that touch plays a communicative role in early father-infant interactions?

To our knowledge there is one study (Shields & Sparling, 1993) which has addressed the touch behaviours of 21 fathers, in a ten minute semi-structured play context with their 3-month old infants. The study examined the quality of touch in relation to paternal and infant demographic characteristics. Using the Touch Protocol; the quality of paternal touch was rated on five dimensions including; (i) *instrumental touch* (purposeful touch; utilized for support and caretaking), (ii) *affectionate touch* (indicative of affection, play and warmth), (iii) *simultaneous touch* (the occurrence of both instrumental and affectionate touch), (iv) *no touch* (lack of tactile contact) and (v) *holding* (supporting the infant's weight). Education and paternal race influenced touch. White (white fathers: M= 4.3, SD= 0.90 vs., back fathers: M= 3.0, SD= 1.00) and more educated (college education: M= 3.9, SD= 1.00, vs. school education: M= 2.8, SD= 0.41) fathers engaged in more touch. Infant characteristics were associated with paternal simultaneous touch; including birth weight (r= 0.55, p=.05); birth order

(first borns: *M*= 1.1, *SD*= 1.65 vs. later-born: *M*= 10.7, *SD*= 10.17). Boys experienced more instrumental touch (*M*= 57.6, *SD*= 27.02) than girls (*M*= 29.9, *SD*= 28.24). Infants with respiratory and cardiac problems at birth experienced less simultaneous touch (*M*= 0.7, *SD*= 1.48) compared to those with no impairment (*M*= 8.5, *SD*= 9.68).

The role of touch in early development

To our knowledge the existing evidence on the influence of touch on early child development is limited to the maternal literature.

In the early postnatal period and during the first six months after birth; maternal touch and close skin to skin contact have been associated with social, physiological and cognitive development (R. Feldman, Eidelman, Arthur, & Weller, 2002; Ferber, Laudon, Kuint, Weller, & Zisapel, 2002; Tessier et al., 1998). Touch and physical contact have an impact on infant regulation (Hertenstein & Campos, 2001) and regulation of the dyad, i.e. coregulation (Moreno, Posada, & Goldyn, 2006). Maternal touch with 3-month old infants has been linked to infant security at 12 months (Weiss, Wislson, Hertenstein, & Campos, 2000).

The type of touch the infant is exposed to in early infancy is associated with later emotional and behavioural development (Weiss, Wislon, Seed, & Paul, 2001). Infants experiencing harsher and more frequent touch are more likely to demonstrate aggressive and destructive behaviours compared to those exposed to nurturing touch. Affectionate touch predicts infant cognitive and neurobehavioural development (R. Feldman, 2003) and promotes positive affect and communication in infants as young as 3-months of age (Stack & Arnold, 1998). In contrast stimulating touch may be

important in promoting communication from the passive infant, thus facilitating the development of social attention and alertness (Ferber, Feldman, & Makhoul, 2008).

The influence of depression on touch behaviours during face to face interactions

To our knowledge there are no studies which have examined an association between depression and the touch behaviours of fathers in early infancy. The literature discussed below in relation to mothers, will describe how parental well-being is expressed through the frequency and type of touch utilized.

Malphurs, Raag, Field, Picken, & Palaez-Nogueras (1996) investigated different types of touch used by depressed and non-depressed adolescent mothers of low socio-economic status (n=80) during face to face interactions with their three month old infants. Depressive symptoms were measured using the (BDI, Beck et al., 1961) and all maternal interactive behaviours were coded by a researcher for type of mother; intrusive, withdrawn or good. Types of touch were classified as *negative* (poking, shaking, tickling, pulling or tugging limbs), *positive* (gentle stroking, or playfulness) and *no touch.* Results suggest that depressed mothers used more negative touch (M= 52.7, SD= 34.9) compared to non-depressed mothers (M= 34.9, SD= 31.2) and they used positive touch less frequently (M= 27.2, SD= 22.7) compared to non-depressed mothers (M= 42.8, SD= 33.6). Depressed intrusive mothers used more negative touch compared to those with a withdrawn profile and spent less time touching the infant than the withdrawn mothers. Correlational analysis to determine the relation between depression classification and touch type indicated a weak association between negative touch and the intrusive profile (r = 0.76, p= .0001).

Ferber (2004) examined the nature of maternal touch in 75 middle-class mothers with children aged 18-42 years, experiencing maternity blues. Maternity blues were detected using Steins Maternity Blues Scale (G. S. Stein, 1980) and the Touch Scoring Instrument (Polan & Ward, 1994) measured the quality of maternal touch. Results indicate that mothers with maternity blues provided less overall touch compared to those without maternity blues in the following touch categories; firm touch (F (1, 64) = 40.52, p <.001), proprioceptive stimulation (F (1, 64) = 16.13, p <.001), vestibular stimulation (F (1, 64) = 15.36, p <.001), light touch (F (1, 64) = 11.35, p <.001), affectionate touch (F (1, 64) = 33.97, p <.001) and matter of fact touch (F (1, 64) = 15.11, p <.0001).

Herrera, Reissland, and Sheperd (2004) investigated the influence of postnatal depression on touch behaviours in depressed (n=18) and non depressed (n=18) mothers at 6 and 10 months post-birth. The Edinburgh Postnatal Depression Scale (EPDS, J. L. Cox, Holden et al., 1987a) was used to assess maternal depression and touch was coded (during five minutes of play with a soft toy) as follows: *direct* (touching the infant's body with hands) and *indirect* (touching the infant's body with a toy). Depressed mothers of 10 month old infants used more direct touch in their communication (M= 2.45, SD= 2.30) compared to control mothers (M= 0.95, SD= 1.21).

We aim to investigate differences in tactile stimulation i.e. *touch* during face to face interactions of depressed and non-depressed fathers. Systematic observations of paternal touch behaviours have not yet been conducted. Based on the maternal literature and the findings on withdrawal and the lack of responsiveness in relation to depression; it was expected that depressed fathers in comparison to non-depressed fathers will touch their infant's less frequently **(Hypothesis 1)** and depressed fathers

compared to non-depressed fathers are more likely to engage in stimulating touch as opposed to gentle touch **(Hypothesis 2)**.

4.2.2 Affective synchrony: Matched smiles

This sub-scale of the P-PATS relates to the 'matching' or 'co-occurrence' of the prototypical facial display of positive emotion, the smile. A review of the literature suggests numerous terms are synonymous with the construct of synchrony such as: 'reciprocity' (J. Belsky, Taylor, & Rovine, 1984), 'behaviour state matching' (T. M. Field, 1995b), 'affect attunement' (Stern, Hofer, Hoft, & Dore, 1985), 'mutual regulation' (Tronick, 1989), 'mutually responsive orientation' (MRO, G. Kochanska, 1997) and 'dyadic synchrony' (Harrist, Pettit, Dodge, & Bates, 1994). The core component of each term involves a close match between parent and infant affective behaviour, which is sensitive to parental responsiveness of infant state and signals. In this study the terms synchrony, coordination, and matching are used synonymously.

Feldman (2007b) refers to three types of synchrony; *concurrent* (co-occurrence of specific behaviours in various modalities i.e. gaze, vocalisation, affect, touch, arousal, body movement, proximity and position), *sequential* (a rhythm or pacing of interactions) and *organised* (the occurrence of a patterned format, for example, shared movement towards high or low attentiveness). Further Feldman, Greenbaum & Yirmiya (1999) measure synchrony in early face to face interactions along three parameters; the *strength of the lagged associations* (the degree of matched communication), *lead-lag relations* (who initiates change in the partners behaviour) and *time-to lag- synchrony* (the pause in time between the change in behaviour of one member of the dyad and a corresponding change in the other member). In the current context we propose that synchrony is a dyadic process; identified during the

matching of positive emotional exchange i.e. smiles. The focus of our examination is on (i) the concurrent occurrence of father-infant smiles and (ii) their lead-lag relations.

These parameters were selected because in the face to face context the emotional state of the parent is crucial to the infant's emotional state (Tronick, 1989). The infant doesn't merely copy parental expression but utilizes varied facial expressions of happiness, sadness or neutrality to guide action and appraisal of the ongoing interaction. Moreover, the mutually coordinated infant-adult emotional communication is bi-directional. Both members of the dyad regulate smiles and vocalisations based on contingent behaviours from the other member (Cohn & Tronick, 1987).

Smiles were chosen because of their distinct indication of pleasure and typical form of expression, and because we anticipate they might be differentially expressed and coordinated by depressed and non-depressed fathers. Additionally smiling is a preferred category of expression for infants postnatally (T. M. Field & Walden, 1982; Nelson, Morse, & Leavitt, 1979) and 3-month old infants are able to scan and fixate on facial expression. Infants at this age are able to discriminate among different facial expressions, mainly pleasure vs. other expressions; moreover they are also able to distinguish within a single category of expression (Kuchuk, Vibbert, & Bornstein, 1986). Infants show a preference for poses of increased intensity of smiles (as a result of their distinguishable, distinct and invigorating characteristics) and their sensitivity to smiles is associated with parental smiling.

Synchrony in the context of father-infant interactions

Field (2003) examined synchrony of positive affect in 100 parents and their infants aged five using the Monadic Phase coding system. The parameters of synchrony derived included, the degree of association, the lead-lag relationship between the members and the time-lag to synchrony. Results demonstrate that fathers were as capable as mothers in matching shifts in infant affect. Their interactions were more synchronous with male infants, characterised by bouts of positive arousal. Increased synchrony across same gender dyads was reported across all three examined parameters. With regards to correlates; paternal attachment security (classified as secure, avoidant and ambivalent based on adult romantic relationships) and positive arousal during interactions were associated with father-infant synchrony.

Aksan, Kochanska and Ortmann (2006) studied Mutually Responsive Orientation (MRO) in 102 families in infants aged 7 and 15 months. Four components of MRO; '*coordinated routines'* (smooth, easy flowing interactions), '*harmonious communication'* (the ability to interpret communication cues), *'mutual cooperation'* (compliance and responsiveness towards the other member) and *'emotional ambience'* (frequent episodes of warmth, pleasure and enjoyment) were examined. Results suggest that at 7 months, mothers implemented more coordinated routines compared to fathers; this difference was not evident at 15 months.

Lundy (2002a) examined the association between parental psycho-social factors (i.e. depression and marital functioning), synchrony and infant attachment in a sample of 30 parents and their infants aged six months. Synchrony was measured during positive (vocalisations and smiles) and negative (infant distress) communication. The results indicate that paternal synchrony was associated with marital functioning (r =

.59, $p<.05$) but not with depressive symptoms (r = -.27, p= ns). An examination of the mediating role of paternal synchrony on the relation between paternal marital functioning and infant-father attachment security, suggests that fathers in dysfunctional marriages, engaged in less synchronous interactions, which in turn predicted lower parent-infant attachment scores.

Synchrony and developmental outcomes

Parent-infant synchrony in the first months of life predicts cognitive and socio-emotional outcomes including, infant attachment security (Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001), self-regulation capacities (R. Feldman et al., 1999), cognitive skills (R. Feldman et al., 1996) and symbolic representations (Damast, Tamis-LeMonda, & Bornstein, 1996). Father-infant synchrony at 3 months predicts theory of mind tasks at 5 years (R. Feldman, 2007b) and to fewer behavioural problems at 2 years (R. Feldman & Eidelman, 2004) pointing to the importance of coordinated states on the child's understanding of emotions in the self and others and the ability to self-regulate.

The long term effects of synchrony across childhood and up to adolescence have been reported in mother-infant dyads. Synchronous interactions at 3 and 9 months post birth, predicts self-regulation (measured by compliance to requests and prohibition of behaviour) at 2, 4 and 6 years (G. Kochanska, 2002). Synchrony also predicts the use of internal state talk at 2 years (R. Feldman & Greenbaum, 1997) and the ability to empathize at 13 years (R. Feldman, 2007a).

The influence of depression on mother-infant synchrony

Maternal depression disrupts all three parameters of synchronous exchange including; the matching of behaviour (R. Feldman & Eidelman, 2007), the degree of coherence (T. M. Field et al., 1990) and the time to lag (Zlochower & Cohn, 1996).

With particular reference to the communication of emotional information; evidence suggests that depressed mothers display flat, stressed or negative affect and experience trouble in regulating their own emotions (T. M. Field et al., 1985). Their emotional displays are likely to influence the temporal parameters of interaction (the matched states) whereby mutual attention is short and episodes of shared affect rare (Tronick & Gianino, 1986); furthermore when synchrony is achieved, it is usually the matching of negativity and distress or disinterest and inattentiveness (T. M. Field, Healy, & LeBlanc, 1989; Jameson, Gelfand, Kulcsar, & Teti, 1997).

Field, Healy, Goldstein and Guthertz (1990) in their investigation on shared states and rhythms between depressed and non-depressed mothers and their infants report that depressed dyads spent less time in shared behaviour states (40% vs. 54%). Negative states were more likely to be matched in depressed dyads compared to non-depressed (anger/poke: 14% vs. 2%; disengaged/look away state: 8% vs. 0%) rather than positive states (play/play: 4% vs. 36%). According to these authors, 'the depressed mother because of her own emotional state, fails to respond to her infant's other-directed regulatory signals and thus fails to provide the infant with appropriate regulatory help' (*p*.9).

To our knowledge synchrony of smiles in the context of paternal depression has not been examined previously. The few studies which have included fathers indicate their ability to engage in synchronous behaviours; highlight different correlates

between mothers and fathers and suggest that maternal and paternal models of synchrony provide the infant with unique experiences. Moreover most studies have focused on the matching of expressive behaviours from different modalities, making it difficult to distinguish between the more frequent onset of certain behaviours and the coordination of specific patterns of behaviour.

The current research thus aimed to assess the degree to which depressed father-infant dyads, compared to non-depressed dyads, matched positive affect using the same modality of expression i.e. smiles. Regarding *concurrent occurrences*, we predicted less synchronous exchanges between depressed father-infant dyads **(Hypothesis 3)**; with reference to *lead-lag relations*, we predicted that depressed fathers would be less likely to initiate a cycle of positive communication **(Hypothesis 4)**.

4.2.3 Physical play and excitatory arousal[13*]

Play is a significant component of the parent-infant relationship and an important context for infant learning (Teti, Bond, & Gibbs, 1988). The literature suggests that fathers engage their infants with a distinct play style described as 'wilder, physically more rambunctious and as a result more exhilarating' (Roggman, 2004). Paquette (2004b) uses the term *'the activation relationship'*, to illustrate the emotional link between father and child established during physical play. Paquette's term includes the excitatory, unpredictable and arousing elements which briefly surprise the infant (Dixon et al., 1981; Labrell, 1994), in the context of physical, playful interactions

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* Note: Physical play and excitatory arousal are individual sub-scales of the P-PATS. However their discussion merits an association as they may occur simultaneously, precede or follow one another within the same interactive context. They are thus discussed within the same section.

more typical of father-infant dyads (Clarke-Stewart, 1978; Crawley & Sherrod, 1984; Power, 1985).

The functions of paternal play

Physical play provides the child with the confidence to go beyond what is easy and familiar, confronting challenge in the presence of parental protection. This is evident in the development of exploration and autonomy in the child as early as the second year of life (M. Yogman, 1994).

Labrell (1994) describes episodes of father-infant play involving ambiguous, unexpected paternal behaviours which challenge the smooth flow of ongoing actions and expectations. These episodes enhance socialization, enabling the infant to cope with the unexpected social environment. The infant is urged to distinguish between the rules of interaction previously established (during contained/calm episodes) and those relating to present activity. Both increased arousal and more predictable episodes are important to cognitive and emotional development.

Pellegrini and Smith (1998) consider the functional aspects of physical activity play in psychosocial development. They suggest that physical stimulation in the first six months corresponds to neuromuscular maturation, evident in the improved control of specific motor patterns and in the development of dominance relationships; whereby the child forms an assessment of their own strength in preparation for future dyadic, affiliative encounters.

The ability to encode emotional information is evident in vigorous play originating in infancy and continuing throughout childhood (J. Carson, Burks, & Park, 1993). The exposure to stimulating play in infancy facilitates the infant to encode and

regulate emotional signals both across the dyad and within themselves. This has not been empirically tested in early infancy, however evidence hints of a positive association between vigorous play episodes and decoding of emotional expressions (happiness, sadness, anger, fright and neutrality) in pre-school children. Hence play in infancy may present an important function of providing the groundwork for the development of social and emotional functioning for later development.

The impact of depression on physicality in play and excitatory arousal

We are not aware of evidence on the impact of depression on physical play in fathers. What is known is that depression impacts on social, emotional and behavioural expression and that depressed fathers tend to be more withdrawn in their interactions. With this knowledge, the current study predicts that the interactions of depressed fathers will be characterised by less physicality and fewer displays of excitatory arousal, compared to non-depressed fathers **(Hypothesis 5)**.

4.2.4 Active engagement

The final subscale of the P-PATS active engagement, involves an examination of the father's level of interest, positive affect, physical and emotional stimulation and energetic involvement. Researchers have used different terms such as 'emotional energy' (Goldberg, Clark-Stewart, Rice, & Dellis, 2002), 'emotional availability' (Sorce & Emde, 1981), 'emotional refuelling' (Mahler et al., 1975 cited in Sorce et al., 1981) and 'parent-active vs. parent-passive situations' (Bridges, Grolnick, & Connell, 1997); all integrating parental sensitive, affectionate and stimulating strategies to engage the infant. Specific behaviours included in this subscale have been discussed in earlier sections of the chapter. The functional role of active stimulation and the impact of depression on this domain are discussed below.

The role of active engagement: Emotional activation overrides physical presence of the parent

With reference to the maternal literature, the development of the mother-infant bond in the 1st year of life is determined partly by maternal accessibility. As this thinking developed, researchers were speculating that infant exploration was promoted not merely by the physical presence of the parent but by the parent's ability in interpreting and responding to the infant's ongoing behaviour. This paradigm was subsequently tested in the work of Carr, Dabbs and Carr (1975) and Fein (1975).

In the first of the two studies; 2-year old infants were placed in a playroom with the mother in one of three physical locations: (i) visible to the infant and facing toys, (ii) visible to the infant with their back to toys, and (iii) not in the infant's field of vision. The mother's physical presence was not enough to facilitate infant exploration of available toys; rather infant's positioned themselves so as to maintain face to face contact with the parent. The results suggest that the parent's emotional availability evident through facial contact may have signalled infant security and subsequent exploration.

Fein (1975) examined whether the exploration ability of 18 month old infants is sensitive to variations in the nature of social encounters, between their mother and an unfamiliar adult. Infants were placed in three differing contexts: (i) mother engaged in reading and had no contact with the experimenter (no-interaction condition), (ii) mother engaged in conversation with the experimenter (conversation condition) and (iii) mother engaged in play with the experimenter, conversation was minimal (game condition). In all three conditions although mothers were physically available; infants displayed the least positive affect and exploration tendencies in the conversation

condition, followed by the no interaction condition. They were most likely to initiate contact with the adults in the game condition. The ongoing signal of maternal communication intent was thus crucial towards the infant's emotional and social experience.

Studies from the maternal literature have supported the notion that in the context of early interactions infants are able to regulate emotions or become emotionally and physiologically organised (Bridges & Connell., 1991; Diener, Mangelsdorf, McHale, & Frosch, 2002). This literature suggests that by reading the infant's behaviour and affective cues, mothers provide the necessary stimulation during communication, which in turn modulates infant arousal and reinforces behaviours. Within this cycle, the infant perceives maternal stimulation and responds by increased attention, communication and positive affect. The contingent response reinforces maternal effort at communication and the dyad experience synchrony.

Is this cycle of events evident in father-infant interactions?

Paternal engagement and active communication during father-infant interactions has been studied in relation to infant emotional regulation, A few studies have compared infant regulatory behaviour during mother-infant and father infant interactions (Bridges & Connell., 1991; Bridges et al., 1997; Diener et al., 2002; Yarrow et al., 1984).

Bridges et al. (1997) studied emotionality in a sample of 12½ to 14-month old infants, exposed to three conditions; parental disinterest, lack of interaction or active communication. Results indicate a strong effect of context (active vs. passive parent) on the emotional expression of the infant and on the emotion regulation strategies

used by the infant. When the parent (mother or father) was disengaged; infants were less likely to engage in active communication, and displayed more negative affect.

Diener et al., (2002) report similar findings suggesting that infants show higher distress levels when they experience less paternal engagement and use distraction strategies to adapt to parent unavailability. Their findings also focus on the importance of positive affect experienced by infants who experience playful interactive episodes and secure attachment relationships with their fathers.

Yarrow et al., (1984) studied early stimulation in relation to infant cognitive development. Sensory stimulation at 6-months of age was related to the infant's persistence at a problem-solving task at 6-months and at the development of sensori-motor skills at 12 months. Other researchers have also reported developmental outcomes in relation to the early animated environment: (i) attention focusing stimulation and measures of infant competence, exploration and motivation behaviour (Gaiter, Morgan, Jennings, Harmon, & Yarrow, 1982; Riksen-Walraven, 1978) and (ii) tactile and kinaesthetic stimulation during father-infant play and infant competence (Clarke-Stewart, 1978). In summary the available evidence suggests that paternal stimulation enables the infant to organise their behaviour and emotions, and that engaged rather than withdrawn interactive behaviours are crucial for the infant's regulatory and cognitive competence.

<u>The presence of depression: Passivity, inactivity and low levels of positive expression of affect</u>

Parental withdrawal and emotional unavailability are associated with depression. Depression interferes with social exchange; the interactions of depressed parents are characterised by fewer positive animated voices and faces, fewer signs of interest and

engagement, less physical and tactile stimulation and fewer attempts at exchanging positive social signals by smiling and eye contact. We thus hypothesise that depressed mood will interfere with the fathers ability to stimulate the infant vocally, physically, emotionally and psychologically; their interactions will be quiet and contained **(Hypothesis 6)**.

4.3 Method

This matched-design study is part of the larger longitudinal project (The Oxford Father's Project, OFP; Chapter 3, p.78). A sub sample of the total study population of fathers and their infants (N=34) constitute the sample.

In chapter 3 the influence of depression on early interactions was examined on a sub-sample of 118 father-infant pairs (p. 80) from the OFP. Paternal and infant behaviours were coded using the GRS. Regression analyses were conducted to control for the effects of paternal age and education as indicated by previous research on paternal engagement (Gavin et al., 2002; Shannon et al., 2006). This sample was also used in the mediational analyses in Chapter 6 (p. 238). In chapters 4 and 5 two exploratory studies were conducted on a sub-sample of depressed and non-depressed father-infant pairs (n=38). A matched design was used to control for the effects of potential confounding variables (paternal age and education) when examining the interaction between depressed and non-depressed father-infant pairs. The rationale for choosing the matched design is discussed below in view of the advantages and disadvantages of selecting controls (non-depressed fathers) for cases (depressed

fathers) according to the presence of suspected confounds rather than relying on statistical analysis to make allowance for their effects.

A major advantage of using a matched design lies in its cost effectiveness and efficiency. The exploratory nature of the studies would subsequently allow for reported group differences from the small sample to be subsequently tested on a larger sample. Hence 38 rather than 118 father and infant pairs were examined in the current context. The design thus implemented also contributed to the statistical efficiency of the data. Matched designs can be efficient in estimating the effect of an exposure when distributions of a confounder are different in the two study groups (Thomas & Greenland, 1983). There is evidence to suggest that depressed men tend to be younger (Kane & Garber, 2004b) and have lower education attainment and income levels compared to non-depressed men (Blazer, Kessler, McGonagle, & Swartz, 1994). Other advantages of matching the two groups include, (i) the control of unmeasured confounders for e.g. environmental and socio-economic factors that are difficult to measure and (ii) ensuring that there are sufficient controls to estimate an effect in a particular group (Wacholder, Silverman, McLaughlin, & Mandel, 1992). A matched design adds precision in drawing group comparisons particularly with small samples by reducing variability in behaviours due to extraneous factors. Some argue that matching also provides a superior method to control confounding, rather than adjusting for potential confounding during the analysis in that 'the functional form of the relationship between the confounding variable and the outcome need not be specified' (Niccolai et al., 2007, p. 2).

On the other hand matching has several limitations which have been frequently cited in the literature. First, it might prove difficult to obtain matched controls (non-depressed fathers) for all the depressed fathers. This was not the case in the current setting as the pool of non-depressed fathers (n= 99) far exceeded the number of depressed cases (n=19). Second, matching can result in the exclusion of depressed fathers when no non-depressed fathers are found. This was not the case in the current investigation. Third, matching may have slowed down progression when the selection of non-depressed cases awaited depressed cases to be identified. Fourth, matched factors can no longer be investigated in the analyses and their effect on exposure or outcome cannot be estimated. Finally, special statistical methods are required to analyse data from matched designs.

Appropriate selection of non-depressed fathers was essential to produce valid, unbiased estimates of group differences. The non-depressed fathers were selected from the same community sample which included the depressed fathers. Two procedures give rise to matched samples (Billewicz, 1964; Wacholder et al., 1992). In the first, the 'matched pair method', the two groups are selected in pairs. Essentially each pair has exactly the same or approximately the same value of the matching factor. The pairs forming the study groups are distinct and each may be regarded as a small experiment in its own right. The second procedure, 'frequency matching', enables an equal distribution of the matching factors in each group. The identity of the pairs is not preserved; rather each group is viewed as one.

In order to remain blind to the case status of the sample a member of the OFP team employed the nearest available matched pair method to select the sample for the exploratory studies. The matched samples were random samples of size (N=19) with pairing of depressed and non-depressed fathers. A list of all the depressed fathers

was generated. The first depressed participant was randomly matched with the closest non-depressed participant (N), followed by the second depressed participant being matched with the yet unmatched closet non-depressed participant (N-1) and so on until all depressed fathers were matched. This procedure was based on a random order nearest available matching method which has been cited previously (Rubin, 1979).

4.3.1 Participants

Recruitment and selection

Subjects were drawn from the same overall sample as in the previous chapter (p.78). The subjects for this study comprised two groups: (i) currently depressed fathers (n=17) diagnosed as experiencing a current episode of major depression and (ii) a group of control fathers (n=17) who scored <10 on the screening questionnaire and had never had major depressive disorder.

Cases and controls were matched on two potential confounding variables (age and education). It was important to control for education as aspects of paternal sensitivity and verbal communication may relate to the amount of time fathers spend in the education system. Fathers were asked to report their highest educational qualification and their response was categorized as follows: 0, 'no qualification; 1, GCSE's or O-Levels; 2, A-levels and other school degrees; 3, diploma or equivalent; 4, undergraduate degree; 5, post-graduate qualification.

Demographic description

Fathers had a mean age of 35.89 years (*SD* = 5.42) were 94.7 % white and 86.8 % were married. Education ranged from 10.5% who had GCSE's to 21.1% with post-

graduate qualifications and 92.1 % of fathers were in full time employment. For the majority of fathers, English was their first language except for two (one German speaking father and another whose main language was Swahili). Of the infants, 47.4 % were first born and 36.8% second born. There were no significant differences between depressed and non-depressed groups on demographic variables *(Appendix 4D, p.408)*.

4.3.2 Procedure

Father-infant face to face interactions were video-taped when the infant was 3-months old, as described in chapter 3. This study utilized data obtained from the floor-mat context. After videotaping fathers were interviewed for depressive symptoms using the SCID.

4.3.3 Measures

Paternal depressive symptoms

SCID (M.B. First, Gibbon, Spitzer, & Williams, 2002a; Chapter 3, p. 84).

Father-infant interactive behaviours at 3-months

Paternal Physicality Affect and Play Scale (P-PATS)

This scale was specifically developed for use in this study and the stages in its development are detailed below.

4.3.4 The development of the P-PATS

4.3.4.1 Identification of specific paternal and dyadic behaviours

This stage involved two related procedures. First, the literature was scanned to identify behaviours which were characteristic of father-infant interactions. We also viewed a sub-sample of interactions from the OFP to identify features of paternal

behaviours in the contemporary father. This allowed current play themes to be cross-checked with the reviewed literature.

4.3.4.2 Identifying and defining subscales of the P-PATS

Merging previous theoretical and empirical findings with currently available data five subscales of the P-PATS were identified. These included: (i) Tactile stimulation, (ii) Affective synchrony: concurrent occurrence of smiles and lead-lag relations, (iii) Physical play, (iv) Excitatory arousal and (v) Active engagement. These scales are defined in table 4.1 (p.149). Discussed below are specific instruments which have guided the measurement of each sub-scale of the P-PATS.

Tactile stimulation

The Touch Scoring Instrument (Polan & Ward, 1994) and the Quality of Parent to Infant Touch Protocol (Moreno et al., 2006) were adapted, to measure individual differences in the quality and type of touch in the current study. The former instrument has differentiated between children with failure to thrive (Polan & Ward, 1994) and mothers with maternity blues (Ferber, 2004). The latter has differentiated between regulatory and dysregulatory functions of touch and the quality of touch in relation to infant activity (Moreno et al., 2006).

Affective Synchrony: Facial coding

The Facial Action Coding System (FACS, Ekman & Friesen, 1978) was used for identifying infant and father facial interactive signals. Although the current study was not designed to classify smile types; a description of the smile types and the muscle groups responsible for changing facial features helped identify intent to communicate and reflected degrees of emotional intensity; in relation to the infant.

The system has been used to identify different types of smiles in differing play contexts and has differentiated between smile-types in the play interactions of mothers and fathers (Dickson, Walker, & Fogel, 1997; Messinger, Fogel, & Dickson, 1999). Four different smile types were used. (Manual: *Appendix4A, p.389*).

Physicality in play

The literature on physicality in play measured Rough and Tumble Play (RTP) in toddlers. Since 3-month old infants were not able to contribute to physical play and fathers were restricted in their use of RTP in the current developmental context, our coding scheme was derived from: (i) a review of video-recordings and (ii) the modification of two systems previously applied by Crawley and Sherrod (1984) (with 10-13 month old infants) and by Yogman (1981) with infants in the first six months of life.

Excitatory arousal

Measurement of unexpected episodes of vocal and behavioural stimulation was adapted from the work of Labrell (1994). Paternal use of teasing entails 'unexpected ambiguous behaviours which destabilize the infant and whose expectations are contradicted', *p.*128. Features of excitatory arousal include some similarities with Labrell's conceptualizing of *teasing*, i.e. indication of emotionality, novelty, surprise and repetitive series of behaviours. Additionally included are behaviours relevant to the face to face context; the occurrence of both the sudden expression of a single episode of behaviour or a repetitive sequence.

Table: 4.1 Sub-scales of the Paternal-Physicality Affect and Touch Scale (P-PATS)

Sub-scale	Definition	Example
Tactile stimulation	The quantity and quality of touch used by the father. Quantity is defined as the frequency of episodes and the total time (i.e. duration) spent touching the infant. Quality is defined as the type of touch used.	
Inactive touch	Resting the hand passively by or on the infant's body and *unmoving*	Hands lying still by the infant on the mat
Light touch	Gently and affectionately holding and touching the infant using the *finger-tips*.	Tickling the stomach gently using the finger tips
Firm touch	Using the *whole hand* to firmly stroke, pat or touch the infant's face, arms, legs and torso region. The father's palm is in contact with the infant's body.	Stroking the infant's tummy with circular movements of the palm
Stimulating touch	*Movement of limbs* back and forth and/ or flexion-extension of the infant's limbs in the context of a game. Stimulating touch involves shaking of the infant's limbs.	Holding and moving the infant's arms up in the air
Active touch	Touch which involves a *change in the infant's body positioning*. Moving the infant from side to side, lifting the infant off the mat or holding the infant's legs in the air.	Rolling the infant on the floor mat and lifting the infant's legs in the air
Practical touch	*Purposeful* touching.	Cleaning the infant's mouth; pulling up socks
Affective synchrony	The matching of dyadic positive emotions	
Frequency	The number of episodes of matched smiles	
Lead-lag relations	The initiator of matched smiles; father or infant?	
Physicality in play	Gross-motor stimulation; an equivalent of toddler rough and tumble play	Lifting the infant off the mat and into the air
Excitatory arousal	Sudden, emotional, unpredictable behaviour; a repetitive and short sequence or a single verbal/non-verbal action which surprises and startles the infant, leading to the sudden arrest of infant activity	Sudden movement towards the infant, followed by a high pitched vocalisation
Active stimulation	The use of vocal, physical emotional and psychological stimulation to create a lively, vigorous interactive environment. The scale taps into paternal interest and motivation in engaging with the infant	Frequent vocalisations, use of touch and, game playing. Animated facial expressions, contingent responsiveness and infant focused behaviour and speech

4.3.4.3 Piloting sub-scales of the P-PATS

Initially a random sample of 15 fathers was coded using the P-PATS *(version 1)*. The coder was blind to paternal case status. The distribution of scores on each scale was analyzed to ensure a spread of ratings. When ratings clustered around one level, cut-off's for the occurrence of behaviour across likert scales were modified. Additionally each scale was subject to a 'video clarity check'. Essentially this procedure was an examination of the video-taped interactions to ensure that all behavioural themes being coded were observable on the screen. Since observational behaviours are influenced by the specific play context and instructions provided to the parent; coding was limited to behaviours visually available within the interaction frame and those which were reliably identified within the methodology involved.

Following this procedure the P-PATS was further refined. This stage led to redefining ambiguous categories and to an increase in clarity in operationalizing behavioural cut-off's across ratings. For example, distinctions in touch type were clarified and redefined to ensure objectivity in coding.

This process was time-consuming; however it was crucial towards establishing clarity across levels of paternal, infant and dyadic behaviours. It also ensured that the scale could be reliably used by trained coders. The final version (IV) of the P-PATS was used to code interactions in this study (*Appendix4A, p.381*).

4.3.4.4 Behaviour coding

The first three minutes of father-infant face to face interactions were coded. All behaviour modalities which represented the sub-scales of the P-PATS were coded separately. Separate viewings to code each sub-scale were thus required. The behaviours were coded continuously and featured a second by second identification

and record on a summary sheet designed for the purpose of this study *(Appendix 4B, p.401)*. There was no predetermined segmenting of the interaction. We did not use an online coding and data analysis system since the sample size for this study was small and the current system employed was efficient, reliable and practical. The coding procedure implemented for each scale of the P-PATS is detailed in appendix 4C, *(p.404)*.

4.3.5 Inter-rater reliability

One additional coder (OE) was trained in the use of the P-PATS. Both coders were blind to paternal case status. Inter-rater reliability between the two coders was established on a random sample of 25% of the data using: (i) Intra-class coefficients (ICC) on interval data and (ii) weighted Kappa on ordinal data. Results are presented in tables 4.2 and 4.3, pp. 151-152. Agreement from both analyses was interpreted using the following guidelines: .40-.59 (moderate); .60-.79 (substantial); .80 and above outstanding (Landis & Koch, 1977). The reliability suggests that apart from active engagement (k= .78), father driven smiles (k= .67) and active touch (k= .74) outstanding agreement was achieved on all other subscales.

Table 4.2 Inter-rater reliability on ordinal data from the P-PATS (*n*=10)

P-PATS scales	**Weighted Kappa**	***SE***	**95% CI**
Active engagement	.78	0.32	(.67-1.0)
Physicality in play	.81	0.11	(.79-1.0)

Note: SE= Standard Error; CI= Confidence Interval; Linear weights applied

Table 4.3 Inter-rater reliability on interval data from the P-PATS (n=10)

P-PATS scales	ICC coefficient	95% CI	*p*-value
Smiles lead-lag			
Father driven	.67	(.33-.92)	.057
Infant driven	.92	(.73-.98)	<.001
Touch *(Frequency)*			
Inactive touch	.89	(.62-.97)	<.001
Light touch	.95	(.81-.98)	<.001
Firm touch	.95	(.83-.98)	<.001
Stimulating touch	.88	(.59-.96)	<.001
Active touch	.82	(.45-.95)	.001
Practical touch	.89	(.64-.97)	<.001
Touch *(Duration)*			
Inactive touch	.92	(.73-.98)	<.001
Light touch	.93	(.76-.98)	<.001
Firm touch	.85	(.52-.96)	<.001
Stimulating touch	.97	(.90-.99)	<.001
Active touch	.74	(.24-.93)	.005
Practical touch	.85	(.51-.96)	<.001
Excitatory arousal	.97	(.88-.99)	<.001

Note: CI= Confidence Interval

4.4 Analytic Strategy

Data analysis was conducted in three stages addressing; (i) descriptive statistics of the scales of the P-PATS, (ii) correlational analysis to test for an association between sub-scales using the Spearman's correlation coefficient (r_s) and (iii) difference in the interactions of depressed and non-depressed fathers using the Wilcoxon-signed-rank test.

4.5 Results

4.5.1 Description of the P-PAT scales

The spread of data using histograms and box-plots suggested that scales were not always normally distributed. Additionally the small sample size suggested analysis of data using non-parametric statistics. Table 4.4 presents the mean values, standard deviations and range for: (i) individual sub-scale ratings and (ii) those of the two touch composites.

Table: 4.4 Descriptive Statistics of the P-PATS (N=34)

Variables of the P-PATS	Mean	SD	Minimum	Maximum
1. Smiles *(Frequency)**	2.39	1.42	0	5
2. Active engagement*	2.80	1.33	1	5
3. Physicality*	3.52	1.34	1	5
4. Excitatory arousal	1.67	1.92	0	6
5. Inactive touch[1]	14.97	18.11	0	60
6. Light touch[1]	30.29	15.09	3	61
7. Firm touch[1]	8.63	13.15	0	75
8. Stimulating touch[1]	13.75	10.80	0	38.89
9. Active touch[1]	4.65	6.52	0	24
10. Practical touch[1]	1.12	2.16	0	11
11. Tactile stimulation[2]	73.40	16.34	32.20	94.42
12. Gentle touch *(composite)*	46.38	17.03	6	83.33
13. Vigorous touch *(composite)*	22.38	15.14	.55	77

Note: [1] Mean proportion of time (seconds) spent in the specified touch type; [2]Total time (seconds) spent in tactile stimulation; * likert scale of 1-5

4.5.2 Correlations between sub-scales

Table 4.5 (p. 155) shows that there was a significant association between paternal active engagement and the occurrence of synchronous smiles (r_s=.54, p=.001), excitatory arousal i.e. unpredictable/emotional paternal behaviours (r_s =.53, p=.001) and the reduced use of light touch (r_s= -.47, p=.004). Fathers who used more physicality in their play interactions, were less likely to touch their infants using light touch (r_s= - .35, p=.039) and more likely to engage in active tactile stimulation (r_s= .79 p= .000). Father's who engaged in unpredictable play to arouse and startle the infant (excitatory arousal) were less likely to touch their infant's vigorously (r_s= -.37, p=.026); instead used inactive tactile stimulation (r_s= .56, p=.000).

Table: 4.5 Intercorrelations among scales of the P-PATS (N=34)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Smiles (Frequency)	1.00												
2. Active engagement	**.54****	1.00											
3. Physicality	.00	.31	1.00										
4. Excitatory arousal	.16	**.53****	.03	1.00									
5. Inactive touch[1]	-.08	.26	-.10	**.56****	1.00								
6. Light touch[1]	-.03	**-.47****	**-.35***	**-.35***	**-.37***	1.00							
7. Firm touch[1]	.00	.23	.19	-.01	-.11	-.09	1.00						
8. Stimulating touch[1]	-.07	-.08	.22	**-.42***	**-.37***	.20	-.04	1.00					
9. Active touch[1]	-.12	.25	**.79****	.24	.01	**-.40***	.14	.04	1.00				
10. Practical touch[1]	.25	.24	.09	-.06	-.13	-.02	.30	-.16	.05	1.00			
11. Tactile stimulation[2]	-.24	-.06	.29	.05	.16	.15	.03	**.36***	.26	-.10	1.00		
12. Gentle touch *(composite)*	-.12	-.12	-.32	.30	**.54****	**.38***	-.25	-.13	-.24	-.14	**.46****	1.00	
13. Vigorous touch *(composite)*	-.08	.07	**.35***	**-.37***	**-.40***	.01	**.50****	**.75****	.21	.03	**.46****	**-.34***	1.00

Note: [1]Time spent in touch type; [2]Total time spent in tactile stimulation; * $p<.05$, ** $p<.01$.

4.5.3 Differences in the interactive behaviours of depressed and non-depressed fathers

4.5.3.1 Do depressed fathers engage in less tactile stimulation compared to non-depressed fathers?

There were no differences in the overall frequency and duration of touch in the two study groups (Table 4.6. p. 157). However an analyses of individual touch types suggests that depressed fathers spent less time in the use of *inactive touch* (*M*=7.79. SD=11.47) compared to non-depressed fathers (*M*=21.95. *SD*= 21.73); *z* = -2.1. *p*=.036. Differences in the duration of stimulating touch by depressed (*M*=17.25. *SD*=11.26) and non depressed fathers (*M*=10.82. *SD*= 17.25) approached significance: *p*=.072.

4.5.3.2 Are depressed fathers compared to non-depressed fathers more likely to engage in vigorous touch as opposed to gentle touch?

Individual touch items were combined into two composites: *Gentle touch* included the mean time spent in inactive touch, light touch and practical touch. This variable corresponds to previous research (R. Feldman & Eidelman, 2003; Ferber et al., 2008; Pelaez-Nogueras et al., 1996). *Vigorous touch* was the mean time spent in firm, stimulating and active touch, comparable to previous studies (Stack & Muir. 1992; Weiss. 1988; Weiss & Wilson, 2006).

The results suggest that depressed fathers were less likely to engage in *gentle touch* (*M*=38.57. *SD*=16.11) compared to non-depressed fathers (*M*=53.37, *SD*=14.97); *z* = -2.44. *p*=.015. There were no mean differences in the vigorous touch composite in the two groups (Table 4.7. p. 158).

Table: 4.6 Mean frequency and duration of touch behaviours in depressed and non-depressed fathers

Scale	Non-depressed (n=17) Mean *(SD)*	Depressed (n=17) Mean *(SD)*	Z	*p*-value
Tactile stimulation *(Frequency)*	26.53 (24.58)	22.71 (8.15)	-.09	.932
Inactive touch	3.06 (2.49)	2.18 (2.58)	-1.17	.243
Light touch	11.00 (16.56)	8.35 (8.64)	-.18	.856
Firm touch	4.29 (3.13)	3.53 (3.94)	-1.01	.311
Stimulating touch	5.29 (7.06)	5.71 (3.04)	-1.33	.183
Active touch	1.53 (1.77)	1.88 (2.15)	-.75	.452
Practical touch	1.29 (2.26)	1.06 (1.75)	-.40	.687
Tactile stimulation *(Duration*)*	75.36 (13.58)	71.23 (19.16)	-.36	.723
Inactive touch	21.95 (21.73)	7.79 (11.47)	-2.1	.036
Light touch	30.17 (17.50)	29.97 (13.77)	-.02	.981
Firm touch	5.99 (4.95)	10.21 (18.12)	-.12	.906
Stimulating touch	10.82 (9.79)	17.25 (11.26)	-1.80	.072
Active touch	4.66 (7.43)	5.19 (5.91)	-.72	.470
Practical touch	1.32 (2.79)	.82 (1.44)	-.408	.683

Note: * Percentage of the total time, i.e. three minutes

Table: 4.7 Mean times spent in gentle and vigorous touch by depressed and non-depressed fathers

Scale	Non-depressed (n=17) Mean *(SD)*	Depressed (n=17) Mean *(SD)*	*Z*	*p*-value
Touch composites				
Gentle touch	53.37 (14.97)	38.57 (16.11)	-2.44	.015
Vigorous touch	21.10 (12.80)	32.62 (20.35)	-1.54	.124

4.5.3.3 Do depressed fathers and their infant engage in fewer episodes of synchronous smiles?

There were no mean differences in the occurrence of synchronous smiles in depressed and non-depressed fathers (Table 4.8, p. 159).

4.5.3.4 Are depressed fathers less likely to initiate an exchange of synchronous smiles?

Depressed fathers compared to non-depressed fathers did not differ in their ability to initiate synchronous smiles (Table 4.8, p. 159).

4.5.3.5 Are the interactions of depressed fathers characterised by fewer displays of physicality in play and excitatory stimulation?

Depressed and non-depressed fathers did not differ in their use of physicality during play (Table 4.8, p. 159). Findings on *excitatory arousal* episodes indicate that depressed fathers were less likely to arouse and startle their infants using sudden, emotional, physical or vocal behaviours (M .71=SD=1.16) compared to non-depressed fathers (M = 2.53, SD= 2.03); z = -.280, p=.005.

4.5.3.6 Are depressed fathers compared to non-depressed fathers less likely to engage in active engagement?

As shown in table 4.8, depressed fathers (*M*= 2.29, *SD*= 1.31) compared to non-depressed fathers (*M*=3.24, *SD*=1.15) were less actively engaged with their infants; *z* = -2.01, *p*= .044.

Table 4.8 Mean differences on individual scales of the P-PATS

Scale	Non-depressed (n=17) Mean *(SD)*	Depressed (n=17) Mean *(SD)*	*Z*	*p*-value
Smiles: Concurrent occurrence				
Synchronous smiles[1]	2.53 (1.42)	2.24 (1.25)	-.38	.702
Smiles: Lead-lag relations				
Smiles- Father driven[1]	1.82 (1.98)	1.41 (1.46)	-.46	.647
Smiles- Infant driven[1]	.71 (1.40)	.77 (.90)	-.39	.695
Physicality in play[2]	3.58 (1.41)	3.65 (1.27)	-.16	.874
Excitatory arousal[1]	2.53 (2.03)	.71 (1.16)	-.280	.005
Active engagement[2]	3.24 (1.15)	2.29 (1.31)	-2.01	.044

Note: [1] Frequency of occurrence; [2] Likert scale of 1-5

4.6 Discussion

This study aimed to broaden the focus of measurement of early paternal behaviours in the context of depression. To our knowledge this is the first study that affords new; albeit exploratory insights on the impact of depression on: (i) tactile stimulation, (ii) synchronous smiles, (iii) physical play, (iv) excitatory arousal and (v) active engagement in fathers. The findings suggest that depressed fathers compared to non-depressed fathers engaged in less gentle touch, fewer episodes of excitatory arousal and less active engagement. There was no evidence of a difference in the synchronicity of smiles, physical play and in the overall quantity (frequency and duration) of tactile engagement between the two study groups.

4.6.1 Differences in tactile stimulation between depressed and non-depressed fathers

The hypothesis that depressed fathers in comparison to non-depressed fathers would touch their infants less frequently was not supported. Previous studies from the maternal literature report higher frequencies of touch among mothers with depressive symptoms (Herrera et al., 2004; Malphurs, Pickens, Pelaez-Nogueras, Yando, & Bendell, 1996). We failed to find such differences in the *quantity* (i.e. frequency and duration) of tactile stimulation in depressed and non-depressed fathers.

These findings can be interpreted in the light of an association between maternal sensitivity and touch; crucial in defining the quantity of tactile stimulation (Weiss et al., 2000). Depressed mothers tend to make increased demands on the infant through higher frequencies of touch. This over-stimulation may originate from decreased sensitivity in attending to the infant's emotional and communicative state. We can

draw on this explanation in the current context. Earlier findings suggest that depressed and non-depressed fathers did not differ in sensitivity in their interactions (p.112). This may help explain why there was no evidence of a difference in their overall use of tactile behaviours.

Additionally earlier findings also suggest that infants in the two study groups were similar on dimensions of positive affect and attentiveness (p.112) which might thus suggest that fathers did not differ on tactile stimulation to regulate infant affect and attention.

The prediction that depressed fathers compared to non-depressed fathers would engage in vigorous touch as opposed to gentle touch was partially supported. The findings indicate that there were no differences in the use of vigorous touch by depressed and non-depressed fathers; however the two groups differed in their use of gentle touch. They are partially consistent with previous findings from the maternal literature (Cohn et al., 1986; R. Feldman, 2003; T. M. Field et al., 1990; Weinberg & Tronick, 1998) which indicate an association between depression and more negative tactile behaviours as opposed to affectionate ones.

A number of interpretations may help in understanding the findings with regards to the vigorous touch composite. First, the small sample size may have resulted in group differences not reaching statistical significance since reported means were in the anticipated direction. Second, the interactive profile of depressed fathers i.e. withdrawn rather than intrusive, reported earlier may contribute to our findings. Suggesting, that depressed withdrawn fathers did not over stimulate their infants, rather their lack of engagement may have been manifested in less active tactile behaviours. Similar results linking maternal depression and touch are reported by

Malphurs, Raag et al., (1996). Depressed mothers classified as intrusive were more likely to use stimulating touch behaviours whereas those classified as being withdrawn were less likely to touch the infant. Third, an interpretation of the findings on vigorous touch may reflect that paternal touch is a part of the global father-infant interactive system. Depressed and non-depressed fathers showed similar patterns of adaptation to their infant's signals and communication experience in previous findings, which might also be reflected in their use of tactile behaviours. Fourth, there is some indication to suggest that this group of well-educated middle class fathers used less overall stimulating tactile behaviours, compared to gentle touch (Means: 22.38 vs. 46.38). A low frequency of stimulating touch may be reflected in a lack of evidence in group differences.

A possible explanation for differences between groups based on gentle touch could be paternal level of experience; indicated by the interaction between depression and infant's birth order. Post-hoc analyses were run to check whether depressed fathers of first born as compared to those born latter differed in their touch behaviours. There were no differences in tactile stimulation in relation to the child's birth order and hence paternal experience could not be a possible explanation for the findings.

Second, that touch facilitates the communication of emotion (Hertenstein & Campos, 2001) may help provide a possible interpretation. Evidence from chapter 5 indicates that depressed fathers direct increased negativity, verbally to their infants. We can thus speculate that this negativity is also channelled non-verbally by the way in which the father's hand impresses on the infant's skin resulting in less gentle infant touch. Emotional negativity in depressed fathers may thus be communicated to the infant via less gentle touch in the same way as lack of positivity is transmitted through verbal behaviours (Jacob & Johnson, 1997).

Third, gentle touch is a positive interactive dimension and as suggested above is more representative of the current sample. It is likely that the observed differences based on decreased use of gentle touch by depressed fathers may indeed reflect an important deficit in the early behaviours of depressed fathers. They may be motivated towards providing a stimulating environment by not engaging in negative behaviours (vigorous touch), but the decrease in positive dimensions (gentle touch) may have a unique impact on the early interactive environment.

4.6.2 Difference in affective synchrony between depressed and non-depressed fathers

Contrary to our predictions there were no differences in synchrony of smiles (concurrent occurrence) and in the initiation of smiles (lead-lag relations) in depressed and non-depressed fathers.

Our findings can be explained by the methodology applied; i.e. the coding of synchrony. Researchers who have studied temporal coordination of early infant communication have used *time-series analysis* in the patterning of emotional (Messinger et al., 2003), vocal (Jaffe et al., 2001) and cross-modality behaviours; infant gaze and mother vocalisations (Crown, Feldstein, Jasnow, Beebe, & Jaffe, 2002). This method allows for the prediction of infant behaviours by the immediately preceding quality of earlier parental behaviours. Our coding which included a second by second record of the occurrence of smiles may not have allowed for a micro-analytic analysis of behaviour between the dyad and the quantification of the lagged association. Further by restricting our measure to the matching of synchronous smiles; other behaviours such as positive vocalisations, motor movements, and increased gaze related to positive dyadic affect were not measured. Hence synchronous interactions when infants shift gaze from inattentive to attentive and the

father responds with a change in social communication (positive facial expression) were not recorded. Finally fathers in general might use fewer smiles as opposed to behavioural and vocal actions in their exchange of positive affect and hence the low frequencies of matched smiles within the sample may additionally explain lack of observed differences.

4.6.3 Differences in physicality in the play of depressed and non-depressed fathers

The prediction that depressed fathers would engage in less physical play compared to non-depressed fathers was not supported. These findings stand in contrast to previous studies of fathers and their infants in play across the first year of life (Clarke-Stewart, 1978; Crawley & Sherrod, 1984; M.E Lamb, 1977; M. W. Yogman, 1981). The findings can be interpreted in the following ways. First, the coding of physicality was based on a single evidence of motor/body movement and hence may have lacked robustness to allow for subtle group differences.

Second, the age of the infant is another likely explanation. Previous research suggests that only in the sixth month after birth is there a peak in gross-motor stimulation (Pellegrini & Smith, 1998). We suspect that at three months, face to face communication in fathers may focus on tactile behaviours and limb movement games rather than active gross-motor stimulation.

4.6.4 Differences in excitatory arousal episodes in the interactions of depressed and non-depressed fathers

The prediction that depressed fathers compared to non-depressed fathers would engage in fewer displays of excitatory arousal behaviours was supported. Although positive arousal in paternal interactions has been consistently reported (Arco, 1983; Clarke-Stewart, 1978; R. Feldman, 2003; M. W. Yogman, 1981); we are not aware

of previous evidence on the influence of paternal depression on excitatory features of father-infant interactions.

The finding indicates that this dimension, which relies on sudden patterns of vocal, motoric and facial expressions in the context of high emotionality, may be more susceptible to paternal depression. Since these behaviours have a sudden and emotional element aimed at startling the infant; they are more likely to be influenced by the affective state of the father. Further that such behaviours are produced as a result of the fathers own level of engagement and interest in the interaction and not in response to a prior behaviour emitted by the infant, they are represented by a distinct motivational characteristic of social communication, which may be particularly disturbed in depressed fathers.

Labrell (1994) suggests *teasing* as the objective underlying these ambiguous behaviours which require the infant to process the novel episode and respond. It thus appears that the core element of these behaviours is to increase attention, social contact and positive emotionality; aspects which are particularly deficient in the socio-emotional and motivational competence of the depressed individual.

4.6.5 Differences in active engagement in the interactions of depressed and non-depressed fathers

Finally depressed fathers compared to non-depressed fathers engaged in fewer episodes of active engagement. This finding is related to emotional, behavioural and psychological behaviours, disrupted by depression. Similar findings have been reported in the maternal literature in relation to the disengaged state of withdrawn depressed mothers (Cohn et al., 1986; T. M. Field et al., 1990). The few available studies on the impact of depression on paternal behaviour report similar findings with regards to paternal withdrawal and lack of engagement (McElwain & Volling,

1999; Paulson et al., 2006; Zaslow et al., 1985). Depression is likely to interfere with the parent's emotional availability to stimulate the infant, evident in laboratory studies that report fewer positive animated faces and voices, decreased levels of interest and less matching of positive affect and communication between dyads (F. J. Elgar, McGrath, Waschbusch, Stewart, & Curtis, 2004; Lundy, Field, & Pickens, 1996).

4.7 Strengths and limitations

While caution should be exercised in drawing strong conclusions from this one study because of the small sample size, limited demographics (white, well-educated fathers) and the exploratory nature of the investigation; the results do shed light on important features of paternal communication in early infancy. It is important to note that small samples are typical for observations that entail second by second coding, (Lavelli & Fogel, 2005). In addition there are a number of strengths to the current study. These include: First, that in the process of developing the P-PATS, we have attempted to link paternal behaviours at 3-months with developmental outcomes and parenting strategies, to develop relevant constructs. References have been drawn from the maternal literature to incorporate the overlap in parental roles, and co-occurrence of behaviours; simultaneously focusing on the father's individual contribution in early infancy. The behaviours observed in the current context do not merely tap into social communication between father and infant, but provide a context for the exchange of emotional, psychological and cognitive information. Second, the scales were reliably administered and coded by blind coders. Third, the

study includes two well-matched groups and participants were diagnosed for depression using a structured interview, rather than a questionnaire for symptoms.

4.8 Conclusion

This study set out to examine differences in the interactions of depressed and non-depressed fathers using a new scale, developed to measure specific paternal behaviours including; tactile stimulation, affective synchrony, physical play, excitatory arousal and active engagement (P-PATS). We found that depressed fathers compared to non-depressed fathers used less gentle touch, engaged in fewer episodes of excitatory arousal and showed less active engagement in their interactions with their infants. This study suggests that by moving beyond the maternal template and measuring behaviours related more closely to the paternal interactive repertoire; researchers can be more accurate in their report on the impact of depression on paternal behaviours.

Chapter 5: Father's speech to their 3-month old infants: The influence of depression on cognitive biases and mentalization

5.1 Study rationale

In this chapter father's speech to their 3-month old infants is examined in the context of depression; thus making a shift from behavioural activity presented in the preceding chapters *(3 and 4)* to an analysis of spoken activity. Communication of which parental speech is a part, at this early stage of infancy plays an important role in laying the foundation for; language acquisition at 2 years of age, the development of the child's attributional style, and emotional and cognitive development (Beals, 1997; Bornstein, Vibbert, Tal, & O'Donnell, 1992). It is thus important to understand the nature of disturbances which occur at the narrative level.

The chapter begins with a description of the two models of parenting embedded within early family interactions; a cognitive model (Beck, 1976) and a mentalizing model (Meins, Fernyhough, Fradley, & Tuckey, 2001). To our knowledge *'cognitions'* and *'mentalization' have* not been examined in the speech of depressed fathers. Cognitions have been examined for several reasons: (i) general evidence suggesting that depressed parents hold negative cognitions about their children and themselves, (ii) depressive affect narrows parent's attentional focus, (iii) parental cognitions are recognized mechanisms significant to a theory of intergenerational transmission of psychopathology and (iv) an intervention approach could utilize knowledge of paternal cognitions associated with depression which are considered important determinants of the parent-infant relationship rather than depression itself (Teti and Gelfand, 1991).

The following reasons contribute to an examination of mentalization: (i) it appears to be a crucial ingredient of parental 'sensitivity', (ii) a growing body of evidence demonstrates that poor parental mentalizing is linked to a greater risk of child psychopathology (C. Sharp & Fonagy, 2008; p. 750) in that 'the mentalization circuitry if broken in the parent, may lead to reduced mentalization capacity in the child, which in turn through deficit emotional regulation processes, may lead to the development of symptoms of psychopathology' and (iii) mentalization based treatments established in various settings including inpatient care, mother-infant dyads and schools; may be applicable to depressed fathers as well.

The development and application of a new measure; The Paternal-Cognitive Attributions and Mentalizing Scale (P-CAMS) is detailed in this chapter. This measure, a modified version of a maternal coding system (L. Murray, Kempton, Woolgar, & Hooper, 1993; L. Murray & Trevarthen, 1986) was used to examine paternal speech. Finally, findings from this exploratory investigation aimed at examining the influence of paternal depression on speech are reported and discussed.

5.2 Introduction

5.2.1 The cognitive model

From a cognitive perspective the function of two processes associated with depression are reviewed: (i) attributional style (the presence of negative cognitions) (ii) attentional bias (self-focused attention). This study aims to understand how these cognitive elements, present in paternal speech, contribute to individual differences in early communication within the two study groups.

5.2.1.1 Cognitive structures associated with depression

Depressed individuals offer a distorted meaning or interpretation of experiences when they encounter stress or negative life events. The common theme that emerges is a cognitive deficit in the processing and appraisal of personally relevant life experiences.

Depression and negative cognitions

Negative automatic thinking is a key cognitive process associated with depression. In his theory of depression Beck defined automatic thoughts as 'depression-inducing self statements that reflect distorted thinking patterns' (Ingram, Trenary, Odom, Leandra, & Nelson, 2007). High-risk individuals tend to process information in a dysfunctional way and focus on negative content. This is reflected in their cognitive appraisal of a situation. In their study comparing cognitive variables in a high risk group (defined on the basis of a previous episode of depression) and those in a control group (low-risk group or those who had never experienced a depressive

episode); Ingram et al (2007) report more negative automatic thoughts in the former participants. Their data suggests that negative thinking characterised the high-risk group and remained in mild to moderate levels even when participants were in remission. Mathews & Macleod (1994) in their study report that depressed individuals attend selectively to negative information, and Burt et al., (1995) suggest that depressed individuals recalled more negative stimuli in comparison to non-depressed individuals. These studies suggest that depressed individuals selectively process negative information.

Depression and self-focused attention

Self-focused attention has been defined as 'an awareness of self-referent, internally generated information that stands in contrast to an awareness of externally generated information derived through sensory receptors' (Ingram, 1990 p. 156). Empirical research suggests a strong relationship between self- focused attention and depression. Smith & Greenberg (1981) studied the association between depression and self-focused attention in a sample of 415 male and female college students. Their results suggest a positive correlation between depressive symptoms and increased self-consciousness. Wood et al. (1990) found that sad participants produced more self-focused responses than those placed in a neutral or happy mood. Ingram et al., (1997) found that clinically depressed individuals report greater levels of self-focus compared to non-depressed controls.

The presence of negative self-schemas is linked to self-focused negativity. Consistent with this reasoning, Carr at al. (1991) found that a depression induction produced more negatively valent self-focused responses compared to an elation induction. Self-focused negativity has also been reported by Ingram & Smith (1984) and

Pyszczynski and Greenberg (1989). In both these studies the depressive self-focusing profile is one that increases negative emotions and negative attributions about the self.

5.2.1.2 Parenting in the context of negative attributions and self-focused attention

Parenting and negative attributions

Researchers have established that within families the presence of negative cognitions shape the way parents interact and respond to their children (Mezulis, 2006). Dix (1991) describes an affective model of parenting to explain how negative emotions reflect dysfunctional interaction patterns and parenting characteristics. Research suggests that negative affect disrupts parent's cognitions, in that depressed parents view their children more negatively. Their interactions are characterised by negative expectations and perceptions of child behaviour (Brunk & Henggeler, 1984; Mash & Johnston, 1982). Depressed parents are more sensitive to aversive stimuli and less attuned towards pleasant or positive communication (Panaccione & Wahler, 1986). Research with mothers suggests that depression affects their tolerance levels towards specific child behaviours (Forehand, Long, Brody, & Fauber, 1986) and relative to non-depressed mothers, depressed mothers make more negative appraisals of their children's behaviour. They tend to evaluate their child's behaviour as being more aversive and maladjusted even when behaviour is not particularly negative, suggesting negative cognitive schemas to induce negative emotions. Consistent with this view Webster-Stratton et al., (1988) report that in comparison to a spouse or a non-depressed mother, depressed mothers describe more behaviour problems with their children and Field (1992) suggests that depressed mothers perceptions of their

infant's behaviour are more negative in comparison to the ratings of an objective observer.

In addition to negative cognitions regarding child behaviour depression also influences appraisals of self-efficacy and control (Bugental & Cortez, 1988). Depressed mothers are more likely to have thoughts of incompetence in the parenting role, and believe they lack control over their children. Teti et al., (1990) in studying the link between parenting impairment and exposure to familial stressors in a sample of depressed mothers report diminished self-efficacy as a primary mediator. Bugental and colleagues (1989) have shown that relative to adults with high-perceived competence and control over their children, parents with less competent beliefs are more negative, withdrawn and show higher reactivity in interacting with difficult children.

Parenting and self-focused attention

Early parent-infant interactions are a particularly complex form of social interaction requiring the parent's sustained effortful attention. Wahler and Dumas (1989) propose that stress narrows parent's attention and distracts them from the task of parenting. As a consequence of focusing on self concerns rather than on the needs of the infant, depressed parents tend to express more negativity, are less empathic and responsive to the infant's ongoing behaviour and may tend to send ambiguous affective messages. Depressed mothers are characterised as being 'mentally disengaged' during joint social interaction, resulting in child distress and high intensity demands in the face of parental control (A. D. Cox, Puckering, Pound, & Mills, 1987). Failure to focus on the ongoing interaction prevents depressed mothers from picking up on their child's cues or putting immediate experiences into a broader

context (T. M. Field et al., 1985). Gelfand and Teti (1990) suggest that self-focused attention may cause parent-child conflict in that it leads the parent to adopt unrealistic expectations of the child's behaviour and affect.

5.2.2 The mentalization model

Mentalization is a term used by both developmental psychologists and psychoanalysts to refer to 'the capacity to ascribe thoughts, feelings, ideas, and intensions to ourselves as well as to others and to employ this capacity in order to anticipate and influence our own and other's behaviour'. Constructs from diverse theoretical backgrounds have been developed to operationalize parental mentalizing (Fonagy et al., 1998, Gotteman et al., 1996, Meins, 1997).

The present study used Mein's (1997) concept of maternal mind-mindedness (MM). From a cognitive-developmental view point, MM is defined as the capacity of the parent within the context of parent-child interactions to treat the child as an intentional agent; acknowledging that the infant is capable of expressing a desire through behavioural, vocal, emotional and attentional communication. Mind-mindedness goes beyond the capacity to read the infant's behaviour and respond appropriately; it is the ability to engage with the infant on a mental level. Engagement at a mental level indicates a reference to the infant's feelings, belief's, wishes, desires and intensions; aspects of mental state manifested in their ongoing behaviour.

5.2.2.1 Paternal use of mentalizing statements

Research has mainly focused on maternal mentalization (McQuaid, Bigelow, McLaughlin, & MacLean, 2008; Ruffman, Slade, & Crowe, 2002; Taumoepeau & Ruffman, 2008) and few studies address the use of mental state language directed specifically to infants (Meins et al., 2002, 2003; Taumoepeau & Ruffman, 2006).

What do we know about the use of mental state language by fathers?

Only four studies have analysed mentalization in paternal speech in relation to: (i) infant attachment (Arnott & Meins, 2007; Lundy, 2003) (ii) children's performance on social-cognitive tasks (LaBounty et al., 2008) and (iii) an understanding of mental states and mentalization about fathering during pregnancy (Lis, Zennaro, Mazzeschi, & Pinto, 2004a).

In a cross-sectional investigation of 24 families, Lundy (2003) explored the association between paternal mentalizing ability and infant attachment security during interactions with their 6-month old infants. Mother-infant interactions were also assessed. Face to face free-play was coded using a modified version of Mein et al's (2001) system for mind-related comments. Findings on gender differences in mentalization suggest that fathers used more problem solving comments (for example; 'have you figured it out yet?') whereas mothers spoke for the infant (for example; 'mommy get me out of here'). Increased use of thought-related comments in fathers was associated with more synchronous interactions, which in turn predicted higher infant-father attachment scores. Mentalizing ability was not associated with the occurrence of depressive symptoms or marital dissatisfaction.

LaBounty et al., (2008) in a longitudinal study of 106 children between 3.5 years and 5.5 years examined emotion and mental state language used by fathers on the socio-cognitive development of their children. Parent's use of mental state language was measured in the context of reading stories and outcome measures encompassed the constructs of 'theory of mind' (ToM; the child's understanding of other people's mental states) and 'emotion understanding' (EU; the understanding of emotional expressions). Findings suggest an association between paternal mentalization, i.e. negative emotion state terms and explanatory references to desires and emotions and the child's development of ToM.

Lis et al., (2004b) examine an association between a father's involvement in the pre-natal period and his mentalizing capacity. They hypothesized a link between mentalizing capacity and acquiring adequate parenting responsibilities; evident in 'an involved' paternal style. Results suggest that the capacity to reflect on mental experiences about the self and others predicted increased involvement in parenting and preparation towards parenthood.

Evidence from the above studies thus suggests that paternal mentalizing occurs in the transition to fatherhood and beyond, bearing important implications for both the parent-infant relationship and social-cognitive and emotional systems in the child.

5.2.3 Mentalization and cognitive deficits in speech: The influence of depression

The paternal literature revealed one published study to date (Kaplan, 2007) which focused on the acoustic and learning promoting properties of Infant Directed (ID)

speech produced by depressed fathers. Kaplan et al., report that speech of depressed fathers with lower vocal pitch (i.e. fundamental frequency (F_o) modulation) was less effective than that produced by non-depressed fathers in promoting voice-face associations. To our knowledge there are no studies which address cognitive and mentalistic constructs in the speech of depressed fathers. The studies addressed below have examined mental state talk and cognitive deficits in speech during mother-infant interactions (Herrera et al., 2004; Kaminer, Beebe, Jaffe, Kelly, & Marquette, 2007; L. Murray et al., 1993). This body of evidence is discussed below to contextualize the potential influence of depression on paternal speech and to guide relevant hypotheses in the current study.

Maternal speech content

Murray et al., (1993) compared the speech of depressed and well mothers with their 2-month-old infants in a five-minute face-to-face play situation. Three maternal groups were included: (i) Mothers who had a depressive episode in the postnatal period (n=29), (ii) those who had a history of depression but no depressive symptoms in the post-natal period (n=10), (iii) control mothers who had no previous history of depression or depression since delivery (n=20). Speech was coded for; infant focused utterances ('questions, expansions and extensions'), negative affect ('corrections, criticism or negative statements') and acknowledgment of infant agency (L. Murray & Trevarthen, 1986). Results suggest that mothers who were depressed in the post-natal period expressed more negativity compared to controls or to mothers experiencing a depressive episode prior to delivery. Their speech was also less infant-focused (for male infants only). Depressed mothers compared to well mothers, were less likely to acknowledge infant intensions and behaviour.

In a replication of the above study Kaminer et al., (2007) examine the association between maternal depressive symptoms, speech content and infant gaze in a community non-clinical sample of 87 mothers and their 4 month old infants. Maternal speech was coded using the first 2.5 minutes of a 10-minute face-to-face play session in the laboratory. Current depressive symptoms were measured using the Centre for Epidemiologic Studies-Depression Scale (CES-D, Radloff, 1977) and the Depressive Experience Questionnaire (DEQ, Blatt et al., 1979) was used to measure depressive experiences of self-criticism and dependency. The results suggest that self criticism was associated with increased focus on maternal experience and less on the infant's experience. Additionally maternal CES-D scores (mean 9.01, *SD*=9.10) were not related to any speech categories (self-focused speech, negative/critical speech, infant agency) when controlling for specific maternal factors (ethnicity, age and education) and infant gender and attentiveness.

Herrera et al., (2004) analyzed the speech of 72 mothers and their infants during a 5-minute 'pleasurable' free play session at 6 and 10 months postpartum. Current maternal depressed mood was assessed using the Edinburgh Postnatal Depression Scale (EPDS) and observations of mother-infant play at home were used to analyze maternal speech. At six months depressed mothers focused less on affective (i.e. internal states and feelings) and informative (i.e. activity and external environment) features in their speech. They were also less likely to verbally share emotional and cognitive aspects of the infant's experience. At ten months depressed mothers were more likely to use negative speech with their infants.

The above findings suggest that maternal postnatal depression influences the functional content of maternal speech. However it is unclear what effect depressed

mood in fathers has on the content of their speech. Predictions below are thus based on; (i) the general literature on mentalization and cognitive deficits in depression and parenting and (ii) maternal speech in the context of depression.

5.3 Aims and Hypotheses

This study aimed to examine the influence of depression in the postnatal period on the speech of fathers with their 3-month old infants. The following specific hypotheses were tested.

5.3.1 Cognitive biases in speech

1. MDD in fathers will be associated with more speech focused on paternal experience (father-focused) and less on the infant experience (infant-focused)
2. MDD in fathers will be associated with more negative/critical infant directed speech and less positive complimentary speech
3. The speech of depressed fathers will show higher rates of negative self cognitions (negative attributions, helplessness) than those of non-depressed fathers

5.3.2 Mentalizing in speech

4. Paternal depression will be associated with decreased speech on the infant's cognitive, emotional and physiological state (internal state agency).
5. Paternal depression will be associated with fewer comments that recognize the infant's intentional behaviour, i.e. gaze, motor movements and vocalisations (external state agency).

5.4 Method

This exploratory study utilized a matched design; depressed (n=19) and non-depressed (n=19) fathers were matched on age and education. It is the same sample described in the previous study (Chapter 4).

5.4.1 Participants

Recruitment and selection

Participants recruited on the postnatal wards were screened for depression using the EPDS at seven weeks and subsequently interviewed with the SCID to assess for clinical symptoms of depression. Details of the procedure are presented in chapter 3 p. 80.

Demographic description

A description of the sample has been presented earlier; chapter 4. p. 145

5.4.2 Procedure

This study utilizes data from father-infant interactions in the car seat context only.

Details of the procedure have been presented in Chapter 3, p.80.

5.4.3 Measures

Measurement of paternal depression at three months

SCID (Chapter3, p. 84).

Measurement of infant reactive temperament (fretfulness)

GRS (Chapter3, p. 84)

Observational measures of infant fretfulness during face to face interactions were used as a measure of difficult temperament. The GRS infant fretful scale (p.86) was used as an indication of infant reactivity defined as; 'infant distress, observed through an angry/protesting cry or vocalization or through facial expression and behaviour; a frown, or agitated, restless body movement' (L. Murray, Fiori-Cowley et al., 1996).

Measurement of paternal speech

Paternal-Cognitive Attributions and Mentalizing Scale (P-CAMS)

This scale was developed specifically for use in this study and the stages in its development are detailed below.

5.4.4 Coding paternal speech

The P-CAMS was a modification of two related systems previously developed for examining maternal speech during mother-infant interactions (L. Murray et al., 1993; L. Murray & Trevarthen, 1986), and incorporated specific mentalization categories from Mein's (2001) construct of 'mind-mindedness'. Detailed below are the stages implemented in the development of the P-CAMS.

5.4.4.1 Stages in the development of the P-CAMS

Speech categories used in the maternal literature

The first system was used to examine those features in the maternal speech repertoire, which differentiated reciprocal mother-infant interactions from non-reciprocal interactions (L. Murray & Trevarthen, 1986) whilst the second (a modified version of the first) was used to examine the speech of depressed mothers during mother-infant interactions (L. Murray et al., 1993). A tabular representation of the main dimensions developed by Murray and colleagues is presented below (Table 5.1, p. 184). The system has five primary categories: (i) Complexity, (ii) Syntax, (iii) Focus, (iv) Negative affect and (iv) Ascription of infant agency. The first two dimensions, i.e. complexity and syntax characterize adaptations to the adult-adult speech register, typical of 'motherese'. Whilst the last three dimensions, i.e. focus, negative affect and ascription of infant agency, represent differences in the speech register of reciprocal vs. non-reciprocal mother-infant interactions.

Table 5.1 Tabular presentation of the coding system used to examine maternal speech (Adapted from L. Murray et al., 1993; p. 1087)

Main speech dimensions and subscales	Description of category
1. Complexity	
Length of utterance	Mean length of utterance
Simple runs	Two consecutive, exact or almost exact repetitions of an utterance
Semantic runs	Two utterance having the same topic of reference, though not the same form
2. Syntax	
Interrogative	Motherese-type syntax
Declarative	
Imperatives	
3. Focus	Focus of speech
A. Infant focused utterances	
Questions	Relating to infant activity
Expansions	Reference to the infant's activity, focus
Extensions	Elaborate on the infant's activity
B. Mother focused utterances	
Directive	Strong commands or suggestions
Prompt questions	Requesting a particular action
Calls for attention	Calling to the baby, exclamations
Corrections/criticisms	Correcting infant activity
C. Other focused utterances	
Immediate	Reference to the immediate context
Non-immediate references	Reference to events removed from the current context
4. Negative affect	
Corrections	Negative emotional content
Criticism	
Negative statement	
5. Ascription of agency	Ascribing agency to the infant

Identification of specific aspects of paternal speech

The second stage involved studying a sub-sample (n=19) of depressed and non-depressed father-infant pairs to categorize utterances in the speech register of fathers. This process allowed the development of dimensions based on prior research and incorporates aspects of speech relevant to fathers. A literature review helped identify aspects of social-emotional communication, which are influenced by depression. This led to the identification of the two cognitive structures, negative attributions and self-focused attention.

Developing categories from measures associated with maternal mind-mindedness (Meins et al., 2001)

This stage involved a modification of the scheme used by Meins et al. (2001) for measuring maternal mind-mindedness in mother-infant interactions. Development of mentalization categories took into consideration the age of the infant (3-months) and the context of play (face to face free-play without toys for 3-minutes). Both infant age and context could potentially have an impact on the speech used by fathers to demonstrate infant agency and intentionality. The original categories used by Meins et al. (2001) are listed below:

1. Maternal responsiveness to change in infant's direction of gaze.
2. Maternal responsiveness to change in infant's object directed action.
3. Imitation; response to infant's vocalisation.
4. Encouragement of autonomy; encouraging infants to perform actions by themselves.

5. Analysing the content of maternal speech for (a) general thought processes, knowledge or desires (b) mental processes (c) emotional engagement (d) attempts to manipulate others thoughts (e) speaking from the infant's perspective.

Identifying and defining the major dimensions of the *P-CAMS*

This stage involved constructing and defining major dimensions and sub-scales of the P-CAMS. Major dimensions include: (a) Infant-focused speech (b) Father-focused speech (c) Experiential reference (d) Other-focused speech. Additionally each comment was classified as appropriate and inappropriate (Meins et al. 2001). The criteria for coding inappropriate comments were modified from Meins procedure and included: (1) comments where the father misinterprets the infant's psychological state (for example, the father continues to suggest that the infant likes a particular rhyme when the infant shows no interest) (2) the parent imposes his own emotional state i.e. negative to describe the activity of the infant. The main dimensions and their sub-scales are presented in tabular form (Table 5.3, p.190). Scale definitions with specific examples of speech are presented in appendix 5A, p.410.

Piloting the developed categories

Following several modifications of the developed scale, a draft version was piloted on a sub-sample of 12 cases. Coders were blind to father's case status. These were not subsequently used in the current study. The spread of ratings for each dimension were analysed, redundant scales removed and ambiguous speech content discussed.

Coding paternal speech

Paternal speech from 3-minutes of uninterrupted father-infant play was transcribed verbatim from videotapes. An utterance was defined as a group of words bounded by silence, a short pause or intonation to signal emotion, a question mark or period at the end of the sentence or thought. Single words, sentence fragments, non-verbal sounds and songs were counted as an utterance. In addition to transcribing paternal comments, the context in which they were made was also indicated on the script. Where sound was not clear (3 cases), reliability was established by asking a member of the team to transcribe the section. Occasional reference to video-clips was made in order to clarify affective tone, infant behaviour/response or ambiguity in context of utterances or infant attention and gaze.

5.4.4.2 Inter-rater reliability

Coding of the P-CAMS was done by two coders. Both coders were blind to the father's case status. Inter-rater reliability was examined using the Intra-Class Correlation Coefficient (ICC), for the subscales of the P-CAMS measure. This approach is considered an appropriate statistical method for studying agreement between sets of continuous data in small samples (<15). A random selection of 25% of the speech samples were coded by the two coders. An ICC coefficient > 0.75 was accepted as evidence of good agreement (Maynard, Bakheit, Oldham, & Freeman, 2003).

Inter-rater reliability on the four major dimensions was as follows: Infant focused speech = .98 (95% CI= .95-.99), p<.001; Father focused speech = .94 (95% CI= .78-

.98), $p<.001$; Experiential reference[14] = .60 (95% CI= .59-.90), $p= .091$ and Other focused speech = .89 (95% CI= .63-.97), $p<.001$.

Inter-rater reliability on attributional style using intra-class correlations were: positive comments = .83 (95% CI= .78-.89), negative comments = .89 (95% CI= .75-.95) and neutral comments = .84 (95% CI= .71-.92). In addition to the above reliability estimates; the percentage agreement established by the two coders is presented in table 5.2 below.

[14] Results on the Experiential Reference subscale indicate inadequate agreement (ICC coefficient < 0.75); hence caution must be applied in the use and interpretation of findings from this scale.

Table 5.2 Coder agreement on the Paternal-Cognitive Attributions and Mentalizing Scale

ID	Infant focused speech			Father focused speech			Experiential reference			Other focused speech		
	Total Utterances	Same codes	% same	Total utterances	Same codes	% same	Total Utterances	Same codes	% same	Total Utterances	Same codes	% same
7927	35	27	**77.14**	6	6	**100**	1	1	**100**	1	0	**0**
600457	42	30	**71.42**	14	10	**71.42**	3	2	**66.67**	3	1	**33.33**
5763	32	25	**78.12**	24	18	**75**	1	1	**100**	0	0	**100**
6244	39	33	**84.61**	10	7	**70**	1	1	**100**	10	8	**80**
6184	50	28	**56**	8	6	**75**	2	2	**100**	3	3	**100**
8932	24	22	**91.66**	7	5	**71.42**	4	3	**75**	3	3	**100**
600003	51	51	**100**	12	7	**58.33**	1	1	**100**	5	5	**100**
8478	52	49	**94.23**	9	6	**66.66**	0	0	**100**	1	1	**100**
9242	21	17	**80.95**	6	6	**100**	0	0	**100**	0	0	**100**
600212	36	27	**75**	7	3	**42.85**	5	0	**0**	17	13	**76.47**

Note: % same for Infant focused speech = 80.92; % same for Father focused speech= 73.06; % same for Experiential reference =84.16; % same for Other focused speech= 78.98

Table 5.3 Tabular presentation of the P-CAMS

1. Infant-Focused Speech

A. Mentalizing comments

Internal-state agency

- Cognitive state comments
- Emotional comments
- Physiological state comments

External state agency

- Gaze and attention
- Motor movements
- Vocalisations and mouthing

B. Non-mentalizing comments

Infant directed attributions

- Neutral
- Positive
- Negative
-

C. Attention orienting/maintaining comments

- Greet/call infant
- Song/game
- Non-verbal sounds

2. Father-Focused Speech

Self-referential comments

- Neutral-Positive comments
- Negative-Critical comments
- Helplessness
-

Attention seeking demands

- Verbal
- Non-verbal

Infant-referential

- Directive speech
- Corrections

3. Experiential Reference

- Reference to the current situation
  Indication of an implicit problem

4. Other-Focused Speech

- Comments removed in time and context

5.4.4.3 The major dimensions of the P-CAMS

Infant-focused speech

Infant focused speech comprised comments directed to or about the infant. This dimension was a reflection of the father's ability to understand and interpret the infant's mental state and use of behavioural actions and their vocal ability to engage the infant. Additionally it included more general comments about the infant. The subscales include: (a) mentalizing comments, (b) non-mentalizing comments and (c) attention orienting/maintaining comments.

Mentalizing measures included: sensitivity to mental i.e. *cognitive state comments* (e.g. 'you like this seat'), feeling states i.e. *emotional state comments* (e.g. 'happy baby') and somatic functioning *i.e. physiological state comments* (e.g. 'are you tired?'). Speech in this dimension also captured the father's capacity to identify a change in the infant's attention and focus i.e. *gaze and attention* (e.g. 'are you looking at the lights') and descriptions of the infant's motor i.e. *motor movements* (e.g. 'are you trying to touch daddy') and vocal expressions i.e. *vocalisations and mouthing's.* The father's capacity to imitate or mirror back their infant's, emotions, behaviour and vocalisation were coded as a reflection of the parent's ability to interpret and respond to the infant as an intentional and meaningful agent.

Non-mentalizing measures included speech on the infant's physical attributes or general description and were categorised as *negative comments* (e.g. 'terrible burden'), *positive comments* (e.g. 'beautiful eyes') or *neutral comments* (e.g. 'you have pink socks').

Attention seeking comments directed to influence the infant's behaviour were also coded under this category and differentiated on the basis of being a paternal demand/goal (no eye-contact) or a joint goal (mutual gaze) representing attunement with and recognition of the infant.

All comments were coded for being accurate and context specific. The literature suggests that the tendency to misinterpret the child's experience seems more apparent in depressed parents, however misinterpretation of infant behaviour was not present in our sample and hence not included in further analysis. Additionally each comment was also categorized on the basis of cognitive attributional style i.e. negative, positive or neutral as affect and negative emotions can disrupt accurate appraisal of communication.

In summary, this dimension of the P-CAMS assessed three aspects of paternal speech found in the original coding system developed by Murray et al (1993). First, focus on the infant; second, identification of negative, positive or neutral affect and third recognition of agency, i.e. a greater sense of the child as a separate being.

Father-focused speech

Father focused speech captured comments about the father. Also included were comments about the infant, which signalled paternal control over infant behaviour. The sub-scales comprised: (a) self-referential comments *(e.g., daddy's not as good as mummy')*, (b) attention seeking demands *(e.g. 'look this way')* and (c) infant-referential negative speech *(e.g. 'sit up')*. Self–referential comments referred to negative, positive or neutral statements about the father *(neutral-positive, negative)* and those indicating feelings of vulnerability in face to face play *(helplessness)*. Demands included both specific verbal requests made by the father *(verbal demands)*

and sounds *(non-verbal sounds)* requiring the infant to change their focus of attention and gaze. Additionally the father may verbalize expressions of dissatisfaction with the infant's behaviour, attentional focus or affect *(corrections)* and indicate through strong commands or instructions to make alterations *(directive speech)*.

In summary comments in this dimension focused on the father's own thoughts feelings and experiences rather than on the infant's experience. Comments referred to the father and included an evaluation of ongoing success and failure, lack of self-efficacy and control over infant behaviour.

Experiential Reference

Comments on the play episode were included under this sub-scale. They were (a) references to the current situation *(e.g. 'this car seat is like yours')* and (b) an indication of an implicit problem (*e.g. 'it's difficult without toys'*). This category was an indication of how the father assesses the play situation. Comments on 'difficulty experienced' during the task or the 'novelty' of the session or perhaps not having to 'play with toys' gave us an indication of the level of discomfort or situation consciousness the father experienced. References to specific aspects of the set-up (for example, presence of the camera or the infant seat) were coded within this dimension.

Other focused speech

Comments in this dimension were not linked to the current play context but were removed in time and place *(e.g. 'I wonder what mummy is doing')*. They included the infant and the father but made no connection to the play context (e.g. *'you had a long sleep'*). This dimension was an indication of the attentional frame of the parent. This

category may help to differentiate between fathers who were engaged in the play context, 'tuned in' to the child's needs and intensions as opposed to fathers who were disengaged from current infant activities.

5.5 Analytic Strategy

5.5.1 Main analyses

First, we examined the average of variables, the dispersion of scores and their frequency distribution. Second, bivariate correlation analyses were conducted to examine the relationship between subscales of the P-CAMS. Third, we tested for differences in the speech of depressed and non-depressed fathers using the Wilcoxon-signed-rank test on: (i) the four main dimensions of the P-CAMS (ii) cognitive biases and (iii) the use of mentalizing statements. This test took into account the matched design of the study. Fourth, we analysed the infant's interactive contribution on the association between depression and infant directed negative comments; by controlling for infant fretfulness. Simple regression analysis was carried out to predict infant directed negativity from a single predictor (paternal depression status). Multiple regression analysis (block-wise entry) was used to predict infant directed negativity from two predictor variables (paternal depression status and infant temperament).

5.5.2 Supplementary analyses

To study the additive effects of paternal depression and infant fretfulness on infant directed negativity we created a variable with four groupings (i. depressed father/ fretful infants, ii. depressed father/non-fretful infants, iii. non-depressed fathers/ fretful infants, iv. non-depressed fathers / non-fretful infants). We compared the mean levels of infant directed negativity in the four groups using the Kruskal-Wallis test, a non-parametric equivalent of the analysis of variance. Similarly by creating four groupings for maternal and paternal depression; (i. both parents depressed, ii. father only depressed, iii. mother only depressed, iv. both non-depressed) we studied the individual and combined effects of parental depression on infant directed negativity. Finally we examined the effects of birth order and infant gender on infant directed negativity.

5.6 Results

5.6.1 Main analyses

5.6.1.1 Exploratory data analysis

Using histograms and box-plots the distribution of scores on the P-CAMS suggested that ratings were not always normally distributed. We additionally used the Kolmogorov-Smirnov test to inform our decision about non-normality. For example, the distribution of cognitive comments in the depressed group, D (19) = .26, p=.001 and in the non-depressed group, D (19) = .22, p=.02, were both significantly non-

normal. In contrast, the distribution of vocalisations in the depressed group, D (19) = .15, p=.20 and the non-depressed group D (19) = .15, p=.20, were both normal. As there were several non-normal distributions and a relatively small sample size, all data were subsequently analysed by non-parametric methods.

5.6.1.2 Bivariate correlations between subscales

There was an association between paternal comments relating to hunger, sleep, wakefulness and satisfaction (*physiological state comments*) and the infant's motor activity or behavioural action (*motor movements*, r =.45; p<.01) (Table 5.4). Fathers used more non-verbal sounds when speech on the infant's gaze and focus of interest decreased (*gaze/attention* r =-.33; p<.05). Infant directed negative comments were related to; father focused negativity (r =.47; p<.01) and comments making reference to another context and time-frame (*other focused speech*, r =.56; p<.01). Fathers who greeted and called out to their infants were less likely to sing or play games with the infant (*song/games* r =-.37; p<.05), but were more likely to make demands of the infant when his/her state didn't permit communication or the attention system was not focused on the parent (*verbal demands*, r =.33; p<.05). Fathers who made verbal demands of the infant were also more likely to instruct the infant (*directive speech*, r =.33; p<.0) and criticize behaviour (*corrections*, r =.55; p<.01). Fathers who attributed positive comments to themselves were more likely to use songs and games over the three minutes of play (r =.32, p<.05).

Table 5.4 Bivariate correlations between subscales of the P-CAMS

Dimension	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
Infant focused speech																						
1. Cognitive																						
2. Emotional	-.11																					
3. Physiological	.02	.13																				
4. Gaze	.21	-.10	-.08																			
5. Motor movements	.02	.20	**.45****	.22																		
6. Vocalisations	.05	-.08	.00	-.10	-.16																	
7. Neutral	.13	-.22	-.06	.25	.18	-.07																
8. Positive	.04	.10	.05	-.13	.21	.20	-.13															
9. Negative	-.09	.09	-.12	-.19	-.14	-.10	.10	-.15														
10. Greetings	-.13	.14	.12	-.16	.07	-.07	-.29	.19	-.10													
11. Songs/games	.04	-.25	.11	.01	-.13	.24	.29	.12	-.18	**-.37***												
12. Sounds	.17	-.30	.04	**-.33***	-.19	.21	-.17	.15	-.12	.04	.04											

Father focused speech																			
13. Self-ref positivity	-.15	.15	.10	-.22	-.05	.23	-.10	.27	-.02	-.03	**.32***	-.19							
14. Self-ref negativity	-.08	.28	-.21	-.15	-.08	-.33	.19	-.24	**.47****	-.00	.02	-.22	.14						
15. Helplessness	.00	-.10	-.18	-.10	-.02	-.06	-.04	-.22	.16	-.20	-.11	-.10	-.10	.27					
16. Verbal demands	-.21	.18	-.01	-.21	-.03	.01	-.18	.24	-.01	**.33***	.01	.05	.02	.12	.05				
17. Non-verbal demands	-.16	-.11	-.13	-.10	-.07	-.27	-.10	-.08	-.09	.25	-.17	.27	-.12	.05	-.01	.01			
18. Directive speech	-.00	.07	-.08	-.13	-.06	-.15	-.07	-.06	.11	.28	-.11	-.14	.32	.30	-.14	**.33***	.08		
19. Corrections	-.14	.22	-.13	-.12	-.02	.15	-.06	-.05	.02	.16	-.10	-.14	.07	.24	.29	**.55****	.05	.31	
Experiential reference																			
20. Situation reference	.08	-.07	.05	.12	-.26	-.13	-.02	-.21	-.13	.04	-.21	-.06	-.00	-.05	.10	-.31	-.30	-.21	-.25
21. Implicit problem	-.13	-.10	-.11	.20	-.15	-.10	-.11	-.12	-.07	-.20	-.06	-.22	.02	-.10	-.04	-.09	-.15	.05	-.15	.10
22. **Other focused speech**	.16	.11	.00	.01	-.10	.12	-.02	-.03	**.56****	.01	-.31	-.04	-.13	.12	-.07	-.25	-.21	-.14	-.13	.20	.03

* $p<.05$, ** $p< .01$

5.6.1.3 Examining differences in the speech of depressed and non-depressed fathers

Preliminary analysis suggested that the mean number of utterances over the 3-minute interaction was less for depressed fathers (*M*= 53.42, *SD*=16.05) compared to non-depressed fathers (*M*=61.53, *SD*= 15.83). This difference was not statistically significant $z = -1.65$; $p=.098$. However, in order to control for any possible effects of verbosity, scores for each speech category were calculated as a proportion of the total number of utterances. The differences between the speech of depressed and non-depressed fathers reported below are expressed as a proportion of the total number of utterances.

<u>The four main dimensions of the P-CAMS</u>

For depressed fathers the mean proportion of *infant focused* comments (i.e. references about the infant or the infant's current experience) were lower (*M*=.60, *SD*= .15) than those of non-depressed fathers (*M*=.72, *SD*= .12), $z = -2.37$, $p=.008$ (Table 5.5). Depressed fathers speech was more *father-focused* (*M*=.24, *SD*=.17) characterised by self-focused comments and experiences and assertion of thoughts and ideas of appropriate infant behaviour, compared to non-depressed fathers (*M*=.14, *SE*= .11), $z = -2.17$; $p=.014$.

Table 5.5 Mean proportion of comments made by depressed and non-depressed fathers on the four main dimensions of the P-CAMS

Main dimensions	Depressed (N=19) Mean *(SD)*[a]	Non-depressed (N=19) Mean *(SD)*	*Z*	*p*-value
Infant focused speech	.60 (.15)	.72 (.12)	-2.37	.008
Father focused speech	.24 (.17)	.14 (.11)	-2.17	.014
Experiential reference	.02 (.02)	.02 (.05)	-.18	.441
Other focused speech	.04 (.07)	.04 (.06)	-.05	.500

[a] *Note:* (i) To facilitate interpretation of the tabulated results on group differences we report means and standard deviations rather than medians and an interquartile range, (ii) Utterances denoting questions and statements, which could not be coded under the above four dimensions were excluded from the analysis and hence the mean proportions do not sum up to one.

Cognitive biases in paternal speech

Attentional focus

As hypothesized and presented above (Table 5.5, p. 200), the speech of depressed fathers focused more on paternal experiences and their appraisal *(father-focused speech)* rather than on the infant's behavioural state and intensions *(infant-focused speech).*

Attributional style: Infant and father focused negativity

The attributional style of depressed fathers was characterised by a higher proportion of negative comments (*M*= .19, *SD*= .16) compared to non-depressed fathers (*M*= .11, *SD*= .13), $z = -2.09$; p=.018 (Table5.6).

Table 5.6 Attributional style in the speech of depressed and non-depressed fathers

	Depressed (N=19)	**Non-depressed (N=19)**		
Attributional style	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Positive	.09 (.10)	.11 (.10)	-.07	.482
Negative	.19 (.16)	.11 (.13)	-2.09	.018
Neutral	.68 (.14)	.77 (.13)	-1.89	.030

To examine negativity directed at the infant, an infant directed negativity composite was calculated from four subscales: (i) negative mentalizing comments, (ii) negative or disapproving comments regarding the infant, (iii) corrections and (iv.) directive speech (Table 5.7, p.202).

Table 5.7 Differences between depressed and non-depressed fathers on infant and father directed negativity in speech

	Depressed (N=19)	**Non-depressed (N=19)**		
Attributional style	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Infant focused negativity	.17 (.15)	.09 (.10)	-2.01	.002
Negative mentalizing	.08 (.09)	.06 (.08)	-1.41	.084
Negative attributions	.02 (.06)	.00 (.00)	-1.99	.031
Corrections	.05 (.07)	.03 (.04)	-1.35	.097
Directive speech	.01 (.02)	.00 (.01)	-2.03	.023
Father focused negativity	.02 (.04)	.00 (.01)	-1.87	.032
Self-referential negativity	.003 (.01)	.001 (.00)	-.813	.416
Helplessness	.01 (.03)	.00 (.01)	-1.36	.173
Implicit problem	.01 (.03)	.00 (.00)	-1.60	.109

The speech of depressed fathers comprised a higher proportion of infant focused negative comments (*M*= .17, *SD*= .15) compared to non-depressed fathers (*M*= .09, *SD*= .10); z = -2.01, p= .002. On the individual sub-scales; depressed fathers speech contained a higher proportion of strong commands and instructions regarding an alteration of infant behaviour i.e. *directive speech* (*M*= .01, *SD*= .02) compared to the

speech of non-depressed fathers (*M*= .00, *SD*= .01); z = -2.03, p = .023. Depressed fathers were also more likely to comment on the infant's physical attribute or general description negatively i.e. *negative attributions* (*M*= .02, *SD*= .06) compared to non-depressed fathers (*M*= .00, *SD*= .00); z = -1.99, p = .023.

A father directed negativity composite (Table 5.7) was calculated by combining scores from three sub-scales: (i) self-referential negativity, (ii) helplessness and (iii) an indication of an implicit problem. Depressed fathers used a higher proportion of self-directed negativity (*M*= .02, SD= .04) compared to non-depressed fathers (*M*= .00, *SD*= .01), z = - 1.87; p=.032.

5.6.1.4 Mentalizing in paternal speech

Overall mentalizing comments

There were no differences in the mean proportions of mentalizing comments made by depressed and non-depressed fathers (Table 5.8).

Internal State Agency

Depressed fathers made fewer references to the infant's somatic functioning i.e. *physiological state* comments (*M*=.02, *SD*= .02) compared to non-depressed fathers (*M*=.04, *SD*= .06), z= -2.13; p= .016(Table 5.8). Suggestive contradictory but non-significant results were found on the mean proportion of emotional comments in the two groups.

Table 5.8 Mean proportion of mentalizing comments made by depressed and non-depressed fathers

	Depressed (N=19)	**Non-depressed (N=19)**		
Mentalizing subscales	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Mentalizing comments [Total]	.32 (.16)	.37 (.12)	-1.01	.166
Internal State agency	.16 (.097)	.16 (.11)	-.16	.445
1. Cognitive	.06 (.06)	.06 (.06)	-2.40	.416
2. Emotional	.09 (.09)	.05 (.05)	-1.37	.091
3. Physiological state	.02 (.02)	.05 (.06)	-2.13	.016
External state agency	.17 (.11)	.21 (.11)	-.97	.176
1. Gaze/Attention	.05 (.05)	.04 (.05)	-.45	.335
2. Motor movements	.02 (.03)	.03 (.04)	-.31	.396
3. Vocalisation & mouthing	.10 (.08)	.15 (.12)	-.98	.173

External State Agency

There were no differences in the mean proportion of external state comments in the speech of depressed and non-depressed fathers (Table 5.8).

5.6.1.5 The infant's interactive contribution

Next, the independent prediction of infant–directed negativity from paternal depression was tested, whilst controlling for infant fretfulness. This examination allowed for the bi-directional influence of paternal and child characteristics to be tested in the context of speech. Father's case status was entered into the regression model first (Table 5.9), followed by an observational measure of infant fretfulness (during father-infant interactions). In the first step of the regression, paternal depression predicted negativity (β = -.33; p =.046). Depression alone accounted for 10.6% of the variation in infant directed negativity. In the next step, there is a drop in the beta value (β = -.29) and depression continues to predict negativity more weakly (p= .064). However infant fretfulness was also a predictor of negativity (β = .29) and the association approached significance (p= .071). The overall model including fretfulness was significant F (2, 35) = 4.59, p<.05 and explained 18.6% of the variance in infant directed negativity.

Table 5.9 Summary of Multiple Regression Analyses predicting infant-directed negativity from paternal depression and controlling for infant fretfulness from father-infant interactions (N=38)

Variable	**B**	***SE* B**	**β**	***p***
Step 1				
Constant	.25	.06		
Fathers case status (1=*depressed*, 2= *non-depressed*)	-.08	.04	-.33	.046
Step 2				
Constant	.19	.07		
Fathers case status (1=*depressed*, 2= *non-depressed*)	-.07	.04	-.29	.064
Infant fretfulness (1= *fretful*, 0= *non-fretful*)	.08	.04	.29	.071

Note: R^2 = .11 for step 1; ΔR^2= .08 for step 2

In order to examine the independent effect of infant fretfulness on father-infant interactions we ran the above analysis again using a measure of infant fretfulness during mother-infant interactions (Table 5.10). In the first step, paternal depression did not predict infant directed negativity (due to the loss of three depressed fathers from this sample). Controlling for infant fretfulness in step 2, there is a drop in beta value from -.27 in step 1, to -.26. Infant fretfulness predicted negativity β = .40, *p*= .015.

Table 5.10 Summary of Multiple Regression Analyses examining the association between paternal depression and infant directed negativity controlling for infant fretfulness from mother-infant interactions (N=35)

Variable	**B**	***SE* B**	**β**	***p***
Step 1				
Constant	.22	.07		
Fathers case status (1=*depressed*, 2= *non-depressed*)	-.06	.04	-.27	.123 *
Step 2				
Constant	.17	.06		
Fathers case status (1=*depressed*, 2= *non-depressed*)	-.06	.04	-.26	.110
Infant fretfulness (1=*fretful*, 0= *non-fretful*)	.10	.04	.40	.015

Note: R^2 = .07 for step 1; ΔR^2= .16 for step 2; * this value has changed since the sample does not include three depressed fathers where maternal data is missing.

5.6.2 Supplementary analyses

5.6.2.1 The additive influence of paternal depression and infant fretfulness on infant directed negativity

As seen in figure 5.1 below the combination of a depressed fathers and a fretful infant is associated with a high level of negativity directed towards the infant (*M*= .21, *SD*= .15). In comparing the mean levels of negativity across the four groups, our findings indicate that infant directed negativity was significantly affected by the combined influence of paternal depression and infant fretfulness ($H(3) = 8.42$, p=.038).

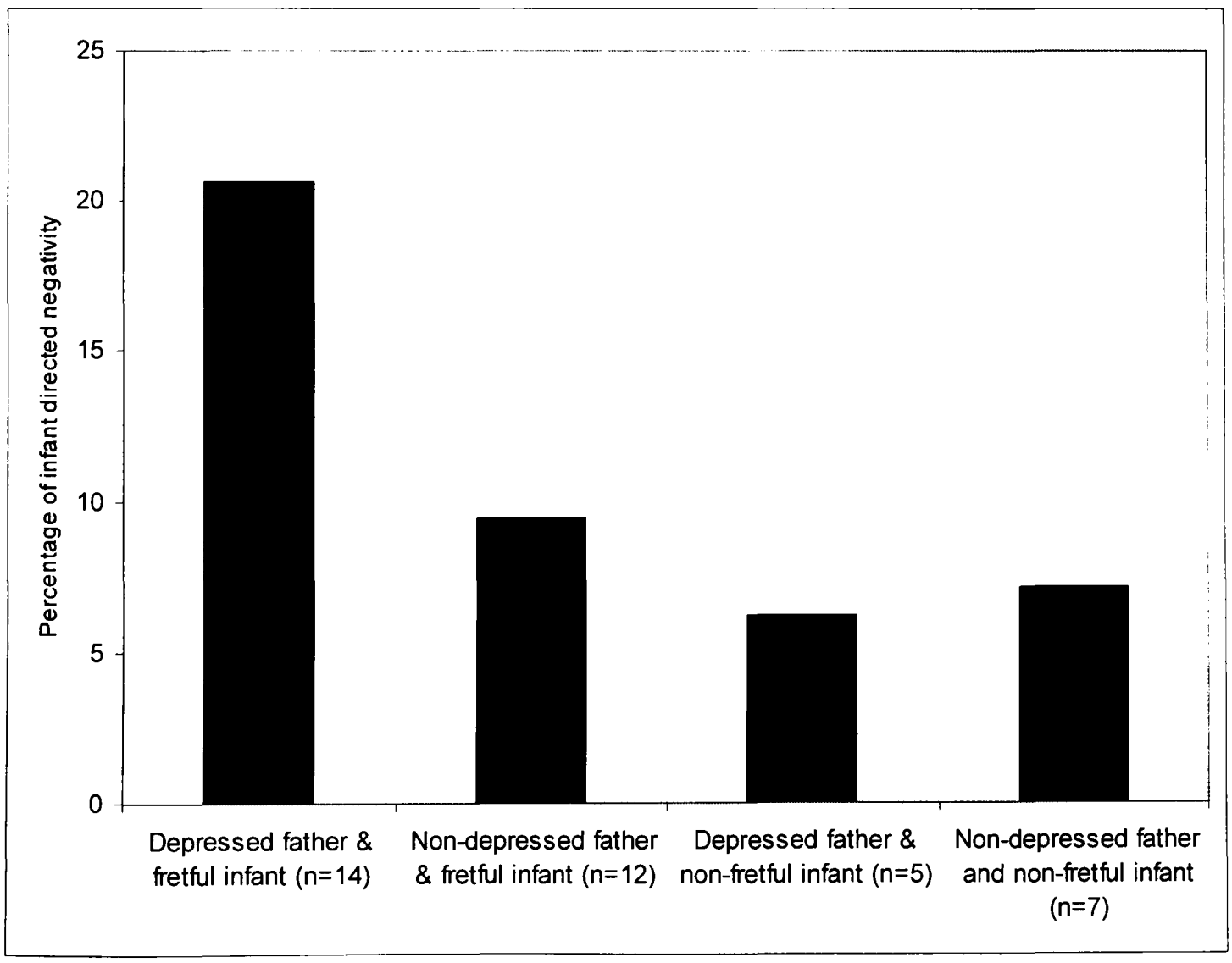


Figure 5.1. The additive influence of paternal depression and infant fretfulness on infant directed negativity

Subsequently we used Mann-Whitney tests between each condition and a control group (non-depressed fathers/non-fretful infants). Negativity did not differ in the depressed father/non fretful infant group (U= 16.50, p=.87) nor the non-depressed father/fretful infant group (U= 33.500, p=.48) compared to the non-depressed father/non-fretful group. However there was a significant difference between depressed fathers/fretful infants (U= 17.50, p=.019) and the control group.

5.6.2.2 The additive influence of paternal and maternal depression on infant directed negativity

Figure 5.2 below illustrates the influence of both parents being depressed on infant directed negativity. Infants with two depressed parents experience increased negativity from their father (M= .32, SD= .07) compared to infants with two non-depressed parents (M=.09, SD= .02). Additionally, there were significant differences in infant directed negativity between the three groups (H (3) = 8.40, p=.038).

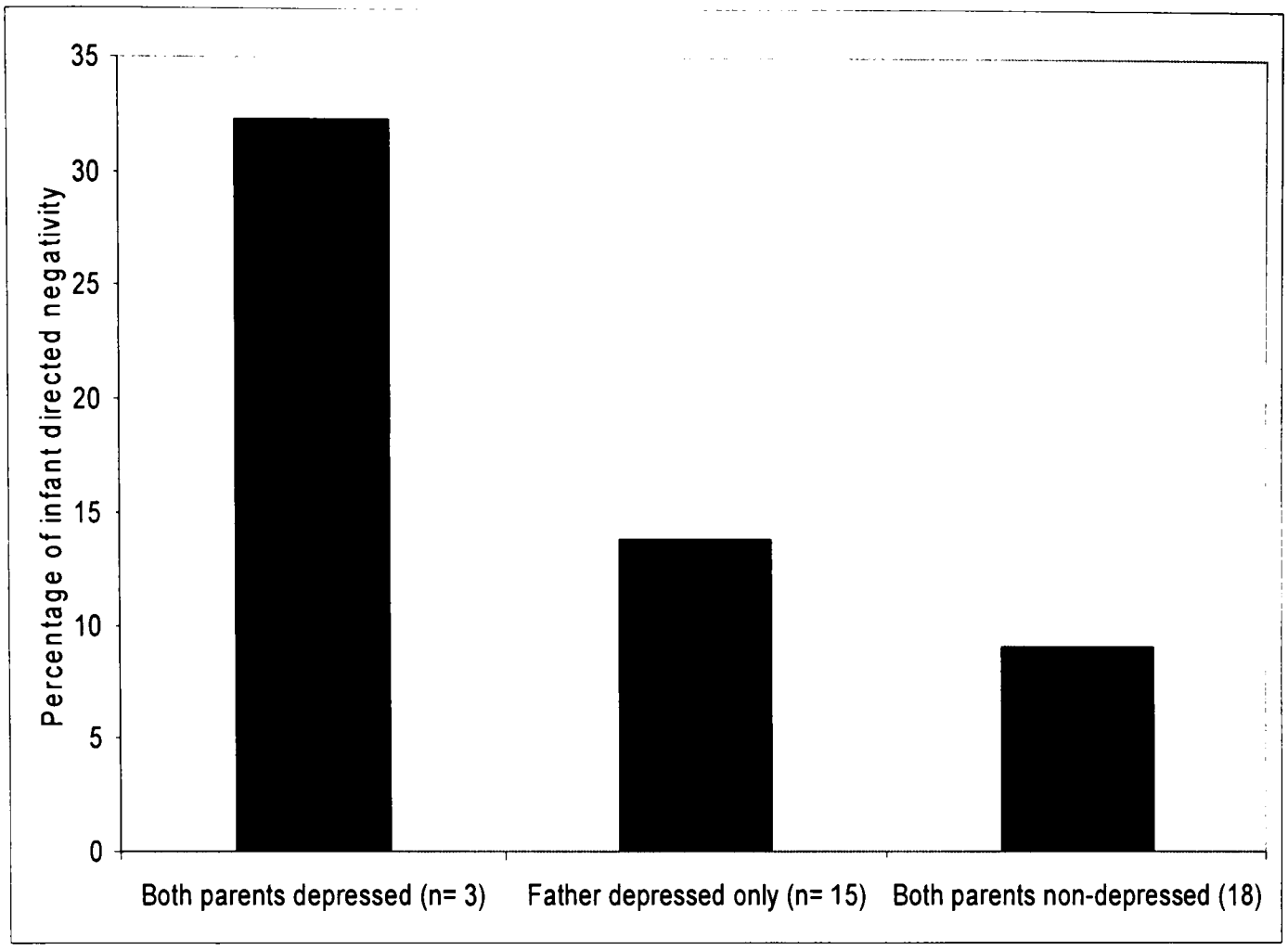


Figure 5.2. The additive influence of paternal and maternal depression on infant-directed negativity

Using a similar analytic strategy to the one discussed above, it appeared that infant directed negativity was significantly different between the group with both parents depressed versus the one with neither father nor mother being depressed (U= 3.00, p=.011). In summary the co-occurrence within families of (i) paternal depression and infant fretfulness and (ii) paternal and maternal depression, indicates an increased level of negativity during father-infant communication as early as 3 months.

5.6.2.3 Effects of infant gender and birth order

Finally we investigated in exploratory post-hoc analyses, whether infant directed negativity varied according to infant's gender and birth order. There were no differences in birth order and no difference between males and females on fretfulness during the interaction.

5.7 Discussion

This exploratory investigation aimed to examine cognitive biases and mentalization in the speech of depressed and non-depressed fathers using a matched study design.

Findings on cognitive biases in speech suggest: (i) depressed father's speech was more self-focused rather than infant-focused and (ii) depressed fathers were more negative about themselves and their infants. Findings from mentalization in speech indicate that depressed and non-depressed fathers did not differ in the use of overall mentalizing comments across the three minute play episode. However on the sub-scales; depressed fathers made less reference to their infant's internal physiological state compared to non-depressed fathers. Finally infant fretfulness contributed to the prediction of negativity in the speech of depressed fathers.

5.7.1 Cognitive biases in paternal speech

Attentional focus

The hypothesis that depressed father's speech would be more self-focused and less infant focused was confirmed. Attentional processes associated with depression have shown that depressed people typically engage in higher levels of self-focus than do non-depressed people (Ingram, 1984; Pyszczynski et al., 1989; Smith & Greenberg, 1981). The results reflect the above general findings and are consistent with findings from the parenting literature, characterising depressed parents as 'self-absorbed,

ruminative and preoccupied' (Gelfand & Teti, 1990) and the maternal literature (Field, 1990, Goodman and Brumley, 1990). The finding is consistent with Murray et al.'s (1993) study on depressed mother's speech to their infants. Mothers who experienced depression were more likely to focus on the self and less on the infant's experience. In the present context paternal self-focus was characterised by self-reflective thoughts of positive, negative or neutral valence *(daddy's doing well for three minutes, 'daddy's no good at this play', daddy's watch)* and infant referential; demands *('come on, give me a smile')*, strong commands or instructions *('pop your hands down')* and corrections *('don't chew your fingers')*. Thus indicating both a focus on self-perception and self-satisfaction indicated through demands made of the infant. Wahler and Dumas (1989) have proposed that stress narrows parents attention and reduces their use of interpersonal information. These difficulties were evident at a verbal level; depressed fathers increase in self-focus.

The process underlying father-focused speech can be explained using Pyszczynski and Greenberg's (1989) profile of the individual's depressive self-focusing style that engages a self-evaluation process. They describe a self-regulatory process whereby the depressed individual focuses on the self following a negative event (in the current framework, the stress of having to interact with the infant) leading to an evaluation comparing the current state (perception of a poor interaction) with the desired state (an engaging interaction, many vocalisations and smiles). Fathers engage in higher levels of self-focus if they experience performance deficits (i.e. failure), however if the interaction is mutually satisfying (i.e. successful) they disengage from the self and attend to the infant or the environment.

Attributional style

The prediction that depressed fathers are more negative about themselves and their infants was supported. Research indicates that depressed individuals experience judgemental biases in the form of attending selectively to negative information (Derryberry & Reed, 1994) and recalling less positive and more negative events (Williams et al., 1996). When talking about themselves depressed fathers were more negative. Their speech included self-focused negativity *('oh, oh daddy hasn't lasted very long has he?)*, helpless comments, *('can't think of anything to do all of a sudden')* and those indicating an implicit problem *('can we manage without any toys?')*. This finding is consistent with previous work which suggests that depressed individuals process and recall information negatively when it is relevant to them (Ingram, 1984). The negativity directed towards the self may be explained in part by the attributional model of Abramson (1978). In the event of infant fretfulness (which in this study predicted negativity) and failure to promote positive emotionality in interactions, depressed fathers are likely to attribute their failure to 'internal, stable and global causes'. The 3-minute interaction in which we examine speech is likely to generate some stress for the father, which coupled with a fretful infant may generate feelings of incompetence and negativity towards the self.

The second finding pertaining to attributional style was that depressed fathers attributions about their infants were negative. These findings parallel those from the maternal literature on depressed mother's speech (Murray et al., 1993; Zlochower and Cohn, 1996, Kaplan et al., 1999) and parenting; attributing negative motives and intensions to children's behaviour (Conrad & Hammen, 1989). In understanding negativity in paternal speech the work of Jacob and Johnson (2001) is particularly

interesting with regards to depressed fathers. In their study on marital communication, sequential analyses of paternal remarks indicated that depressed men showed less positivity following positive remarks made by a partner. This pattern of 'positivity suppression' increased with depression severity. This suppression of positivity was also present in parent-child interactions in families with a depressed father. From a difference in perspective to the broader literature, they focus on lack of positivity rather than the presence of negativity in communication to be more indicative of depression. Sequential analyses of speech were beyond the scope of this study; however our findings on overall attributions in paternal speech did not fit with this alternative framework. Depressed fathers were more negative and used less neutral speech. No differences arose on positivity in speech, perhaps highlighting the importance of the infant's interactive contribution and the current context of play. A post-hoc qualitative viewing of videotapes indicated moments of 'positivity suppression' following episodes of high-pitched, positive infant vocalizations or lively motor movements. Paternal comments subsequent to these episodes included, *'you're very loud and noisy today'* or *'you're very wriggly, trying to get out of the seat'*.

5.7.2 Mentalizing in paternal speech

The hypothesis that depressed fathers would communicate fewer mentalizing comments in their speech was not confirmed. These findings were consistent with a study by Lundy (2003). However results on individual sub-scales indicate that depressed fathers spoke less about their infant's physiological state (internal state comment). This finding may suggest that age and developmental level of the infant are determinants of child directed speech (Herrera et al., 2004). The maternal

literature; indicates that talk about the infant's internal state occurs prior to talk about activities and the external environment. It is thus possible that father's speech at 3 months focused on the infant's physiological state rather than on activity and vocalisations and was influenced by depressed mood. Additionally at three months fathers may not be as familiar as mothers are on their infant's internal state and external intensions; perhaps a difference across groups would be more evident in older children.

There was weak evidence that depressed fathers were more likely to talk about their infant's emotional state. Post-hoc analysis indicated that a higher proportion of emotion state comments in the depressed group were negative (M= .05 *SD*= .09) compared to those in the non-depressed group (M= .01 *SD*= .04); $z = -1.977$, $p = .048$. This finding is consistent with LaBounty et al., (2008) who report the use of emotion terms (desires and feelings) and over-all talk about negative emotions in paternal speech to their 3.5 year old children. One would expect that father's emotional state comments would be negative in the case of fretful infants. Findings from chapter's three and four suggest that infants of depressed and non-depressed fathers did not differ in their fretful behaviour. Thus it is likely that depressed fathers are more sensitive and negative to the emotional content of interactions.

The infant's limited capacity of social-cognitive communication at 3 months may suggest why overall differences in mentalizing comments were not found. Regarding the context of speech; it might be likely that mental state talk is spoken during some type of activities and not others. Fathers have been found to engage in more arousing play, the face-to face car seat context may not facilitate the verbal expression of mental state experience of the infant. Finally at three months fathers may not be as

familiar as mothers in acknowledging the child as an intentional agent or may do so in their own idiosyncratic way.

5.7.3 The infant's interactive contribution

A central finding of the current study was that depressed fathers expressed more verbal negativity about the infant compared to non-depressed fathers. It was also reported that the link between paternal depression and infant directed negativity was affected by the infant's difficult temperament. Infants who were fretful in the presence of a depressed father experienced the most negativity and non-fretful infants with a non-depressed father the least. There is increasing evidence of the association between infant temperament and dynamics of father-child interaction (Komsi et al., 2008, McBride et al., 2002, Kochanska et al., 2004). Our findings are consistent with Volling and Belsky (1991) who found fathers of difficult infants were less affectionate and responsive behaviourally and with Kochanska et al. (2004) who report 29% of the variance in affective ambience in father-infant relationship to be explained by the infant's temperament. However they stand in contrast to other studies on infant negativity and aspects of fathering (Jain, 1996, Woodworth, 1992, Volling, 1992).

These findings can perhaps be understood in the light of the interactions between a father and his infant. First with reference to the model of 'harmonious interactions'; characterised by the matching of affective and attentive behaviour states (Beebe et al., 1992, Brazelton et al., 1974 cross ref.) parallels are drawn to narrative discourse. The findings imply that depressed fathers are less attentive to the infant, providing inadequate stimulation (indicated by the use of fewer songs/games and non-verbal sounds). In this context the infant may fail to regulate behaviour and affect. This may

lead to higher levels of eliciting fretfulness and subsequent negativity in the speech of depressed fathers. The infant's coping strategies in response to paternal inattentiveness may involve protesting and agitation as suggested by Tronick & Gianino (1986). In essence the infant's behaviour matches the father's level of engagement and positive expressiveness. Alternate explanations focusing on infant to father effects, include some infant's being genetically predisposed to being more difficult and fussy leading to increased paternal negativity.

5.8 Strengths and limitations

This is the first study to examine the speech content of currently depressed fathers and the association between infant temperament and verbal aspects of speech in father-infant interactions at 3-months. It is in this phase of child development that 'certain environmental experiences exert a particularly strong effect on brain development' (Stein et al., 2008). Hence exposure to negativity and lack of focus on the infant could lead to adverse infant development. The findings validate two important aspects; links between specific father (depressed vs. non-depressed) and infant characteristics (fretful vs. calm) and the quality of the interaction (positive vs. negative). A community sample which is more indicative of difficulties in the general population was utilized. Clinical interviews to diagnose depression and observational ratings of infant fretfulness were utilized. Paternal speech was rated by coders who were blind to paternal case status and adequate reliability on the scales was achieved.

This study has several limitations. First, the small sample size warrants caution. Two cautions in terms of analyses should be noted: (i) the actual amount of variance produced by the predictors was relatively small, it would be important to continue to search for additional factors which might explain more of the variance, (ii) the possible risk of Type I errors, given the number of statistical tests undertaken should also be considered, however differences in means between the two groups were consistently in the expected direction. Our participants were mainly Caucasian, middle-class, slightly older fathers, hence generalizability of the findings may be limited. The study utilized a correlational design, which precludes delineation of causal pathways; however these preliminary findings suggest interesting possibilities about the cognitive processes that serve as links between depression and infant directed negativity. An issue not addressed in the current design is the extent to which the infant's fretful behaviour can be attributed to genetic risk and the interactions of genes and the environment (exposure to paternal depression) on infant experienced negativity.

5.9 Conclusion

This exploratory study is the first to our knowledge to explore the cognitive and mentalizing content of paternal speech in the context of depression. Results suggest that depressed fathers focus more on themselves and less on the infant. Both father focused and infant focused attributions are negative. Finally infant focused negativity is driven by the infant's difficult temperament. Our data allude to a possible pathway between paternal pathology and child functioning. A better understanding of these

processes might facilitate researchers and practitioners in detection and prevention as early as the ante-natal period, encouraging fathers to engage in speech that will most benefit the developing infant.

Chapter 6: Paternal depressive symptoms and child externalizing behaviours: The mediating role of father-infant interactions

6.1 Father-infant interactions: A brief summary to this point

In the preceding chapters of this thesis the potentially important role of father-infant interactions has been described. In chapter two, a systematic review of existing longitudinal studies was undertaken to determine the impact of observational measures of early father-infant interactions on subsequent child functioning. Results indicated that early interactions were consistently associated with linguistic development. In chapters three, four and five, face to face interactions in the context of paternal depression were examined. Depressed fathers were more likely to be behaviourally disengaged and verbally negative compared to controls.

In this chapter one final issue is addressed: This study will explore a possible mechanism (i.e. early father-infant interactions) in the intergenerational transmission of risk; from paternal pathology (i.e. depressive symptoms) to poor child outcome (i.e. externalizing child behaviours). It will test whether the presence of paternal depressive symptoms has a negative impact on early father-infant interactions which in turn may contribute to child behavioural difficulties (Figure 6.1).

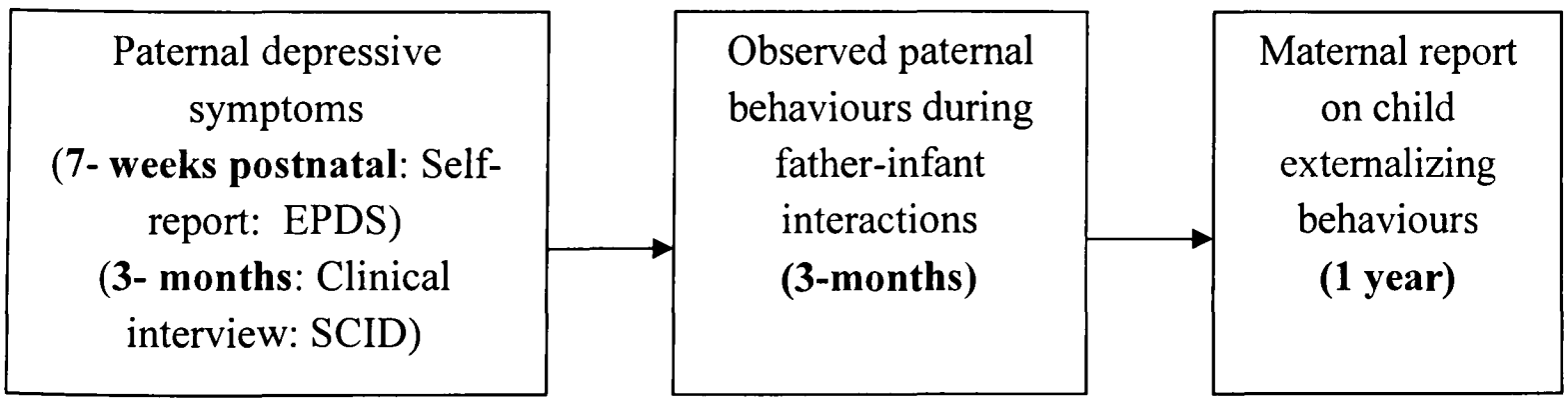


Figure 6.1. The intergenerational transmission of risk: The mediating role of early interactions

6.2 Study rationale

The current investigation is important for a number of reasons. First, the identification of a potential pathway (i.e. disruption in early parenting) in the transmission of risk from parent to child could enable depressed parents to receive the appropriate help to optimize their child's early rearing environment, thereby alleviating some of the environmentally mediated risk to their child. An examination of the early interactive environment is particularly important as previous evidence indicates that parents who experience depressive symptoms might continue to engage in maladaptive parenting behaviours, even after a decrease in their symptomatology (Brown & Harris, 1978). Moreover, intervention studies suggest a reduction in infant behavioural problems with an increase in sensitive parenting (L. Murray, Cooper, Wilson, & Romaniuk, 2003). This mediational investigation would thus suggest an important clinical implication; teaching fathers appropriate parenting/interaction skills.

Second, from the perspective of early child externalizing problems numerous reasons support the identification of a potential pathway: (i) Prevalence rates of externalizing behaviours are approximately 5-13% in pre-school children (Lavigne et al., 1996), (ii) the presence of early externalizing behaviours are relatively stable from toddlerhood to age 5 years and into adolescence (Campbell, 1995; E. M. Cummings, Iannotti, & Zahn-Waxler, 1989; Miller-Lewis et al., 2006), often continuing into adulthood (Moffitt, 1993), (iii) behaviour difficulties starting early over the course of development show a more persistent and chronic course (Shaw, Owens, Giovannelli, & Winslow, 2001), (iv) encompassing widespread social and financial consequences (Scott, 2001) and (v) are often related to other comorbid disorders; for example

social and academic problems in later childhood (Kingston & Prior, 1995). Hence identifying behaviour problems in early infancy might have long term implications for the child's adjustment.

Third, depression may be related differentially to the parenting practices of mothers and fathers. Jacob and Johnson (2001) report that maternal depressive symptoms are associated with a general negative affective tone, whereas paternal depressive symptoms are associated with reduced positive interactions. Fourth, some evidence suggests that there are differential pathways in which paternal and maternal symptoms of depression are related to children's behaviour problems (Marchand & Hock, 2003; Middleton, Scott, & Renk, 2009). These results thus support gender specificity in the family process whereby paternal mental health may initiate specific pathways to child mental health problems.

Fourth, there is sparse information on the measurement and epidemiology of psychopathology in pre-school children. Koot et al., (1997) attribute problems in defining psychopathology in very young children to; (i) difficulties in differentiating between dysfunctional behaviours and those linked to normal development in children below four years, (ii) lack of agreement in the reporting of problems and their severity between informants and consequently (iii) the varying range of child difficulties reported by previous findings, i.e. 6-50% (Koot & Verhulst, 1991).

In the current context externalizing rather than internalizing behaviours were examined at 1 year because of a lack of suitable research measure for internalizing problems in this age group, difficulties in interpreting internalizing behaviours and rapid developmental changes resulting in a lack of differentiation between transient behaviours or those indicating subsequent malfunction. There is however some

evidence for the presence of externalizing problems in children as young as 12 months (Carter, Briggs-Gowan, Jones, & Little, 2003; Tremblay, Pihl, Vitaro, & Dobkin, 1994; van Zeijl et al., 2006). Carter and colleagues used the Infant-Toddler Social and Emotional Assessment (ITSEA) to measure aggression in children aged 12 to 17 months whereas Tremblay et al., measured aggressive behaviour as rated by parents on a three point scale and report that the age of onset of physical aggression is around 12 months. More recently Van Zeijl (2006) assessed behaviour problems in a population sample of 786 infants aged 12 months using the Child Behaviour Checklist (CBCL/ 1½-5). The results confirm previous reports on the occurrence of behaviour difficulties as early as 12 months and also indicate; (i) agreement in reported behaviours by both mothers and fathers and (ii) the stability of behaviour problems over a one year period.

A further explanation linked to the examination of externalizing rather than internalizing problems includes findings from previous studies on paternal depression and child outcome. Paternal depression in the postnatal period is associated with externalizing and not internalizing problems in children 3.5 years of age and this association continues to persist at age 7 years (Ramchandani et al., 2005; Ramchandani et al., 2008).

The layout of this chapter is as follows: research supporting each pathway of the above mediational model is discussed; next the study methodology is addressed, followed by an analytic strategy, a report of the main results, their discussion and finally concluding comments.

6.3 Research supporting each pathway of the mediational model

6.3.1 Paternal depression and child outcome

The association between paternal depression and child outcome has been discussed in an earlier section of the thesis (Chapter1, p.14)

6.3.2 Depression and parenting[15]

The influence of depression on parenting behaviours and early interaction has discussed in an earlier chapter of the thesis (Chapter, p.17).

6.3.3 Parenting and outcome[16]

Parenting in relation to child outcome has been examined in chapter 2.

6.3.4 The role of paternal behaviours in the transmission of risk

There are a number of different mechanisms by which mental health problems in parent's impact on children and increase the risk of worse child outcomes. These have been addressed in chapter 1 (p.22). In the current study, the mediating role of dysfunctional parenting is examined. Addressed below are five studies which have included fathers, in examining a model of mediation by parental behaviour in the links between depressive symptoms and child behavioural outcome.

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[15] For specific studies in the postnatal period refer to appendix 1A

[16] Studies focusing on observational measures of paternal behaviours in relation to outcome are presented in appendix 2D

In 184 high risk families (Burt et al., 2005) found that maternal and paternal parenting behaviours (conflictual relationship) mediate the association between depression and off-spring externalizing behaviours in late adolescence. The data analysis involved a composite measure of parenting; and hence the study precluded a test of mediation by each parent individually. Elgar, Mill, McGrath, Waschbusch and Brownridge (2007) showed that the quality of the child's rearing environment (measured through child reports of parenting) was a potential mechanism of transmission of risk in 330 parents and their 10-15 year old children. Both positive behaviours (nurturing and monitoring) and negative behaviours (rejection) were potential mechanisms identified in the links between parental depression and children's externalizing behaviours, internalizing problems and pro-social behaviour. Although this study demonstrated the inadequacies in parenting as a potential mediator; less than 10% of the parents who participated were fathers, moreover the parenting scale completed by the child did not indicate which parent they reported on and a combined perception of maternal and paternal parenting behaviours was provided.

Low and Stocker (2005) report on observational and child reports of father-child hostility as a pathway linking paternal depressed mood and oppositional behaviours in a community sample of 136 ten year old children. A 'hostility' composite was derived for both parents separately; combining child reports of parent's negative affect and observational ratings on hostile behaviours (anger, irritation, annoyance, scolding, criticizing). Using path analysis for each parental model of mediation, fathers depressive mood was indirectly linked to children's externalizing problems through father-child hostility. This study used multiple informants to avoid 'mono-informant bias' (*p*. 400) whereby each parent rated their own depressive symptoms,

child externalizing problems were represented by a combination of maternal and paternal ratings.

Kane and Garber (2009) demonstrated that child ratings of father-child conflict mediated the link between father's depressive symptoms and children's externalizing behaviours. The study utilized a high risk design; including 81 children (of mothers with and without a history of depression) with an average age of 11.8 years. Separate forms on conflict behaviour were completed by the child for each parent, and the mediational model was supported above and beyond the effects of maternal depression.

Leinonen, Solantaus, Punamki (2003) in studying the process of transmission of mental health problems in a community sample of 527 families, address the importance of specific pathways in relation to parent and child gender. The quality of parenting was measured using parental reports on the following aspects: expression of feelings, discussing different topics, learning about the child's whereabouts and the use of discipline. Three factors were identified; i.e. authoritative, punitive and non-involved. Results suggest that in female children, depressed fathers displayed more punitive parenting strategies which were associated with subsequent internalizing symptoms and poor school performance. For males, paternal depressive symptoms were related to punitive measures of parenting; however the specific outcomes indicated were depression, substance abuse and school performance.

These studies indicate that for older children and adolescents, paternal behaviours are a possible pathway of risk transmission. Are these results specific to this age group or is parenting equally relevant to the transmission of risk in infancy? To our knowledge there have been no studies of this kind undertaken in infancy. This study

thus aims to test such a model to extend the above findings to an earlier stage in development.

6.4 Aims and Hypotheses

6.4.1 Primary Aim

This longitudinal study aimed to examine a potential mechanism (i.e. father-infant interactions) in the intergenerational transmission of risk.

6.4.1.1 Primary hypothesis

The association between paternal depressive symptoms and externalizing behaviours in children is mediated in part by paternal engagement observed during father-infant interactions

6.4.2 Secondary Aim

In the course of testing the above hypothesis the study also aimed to examine whether paternal interactive behaviours at three months are an independent risk factor for child externalizing behaviours.

6.4.2.1 Secondary hypothesis

Decreased paternal engagement *(communication of low-energy levels; remote, withdrawn verbal and non-verbal behaviours and negative affect)* is an independent predictor of increased externalizing problems, after controlling for paternal demographics, maternal sensitivity and infant reactivity, i.e. fretful temperament.

6.5 Method

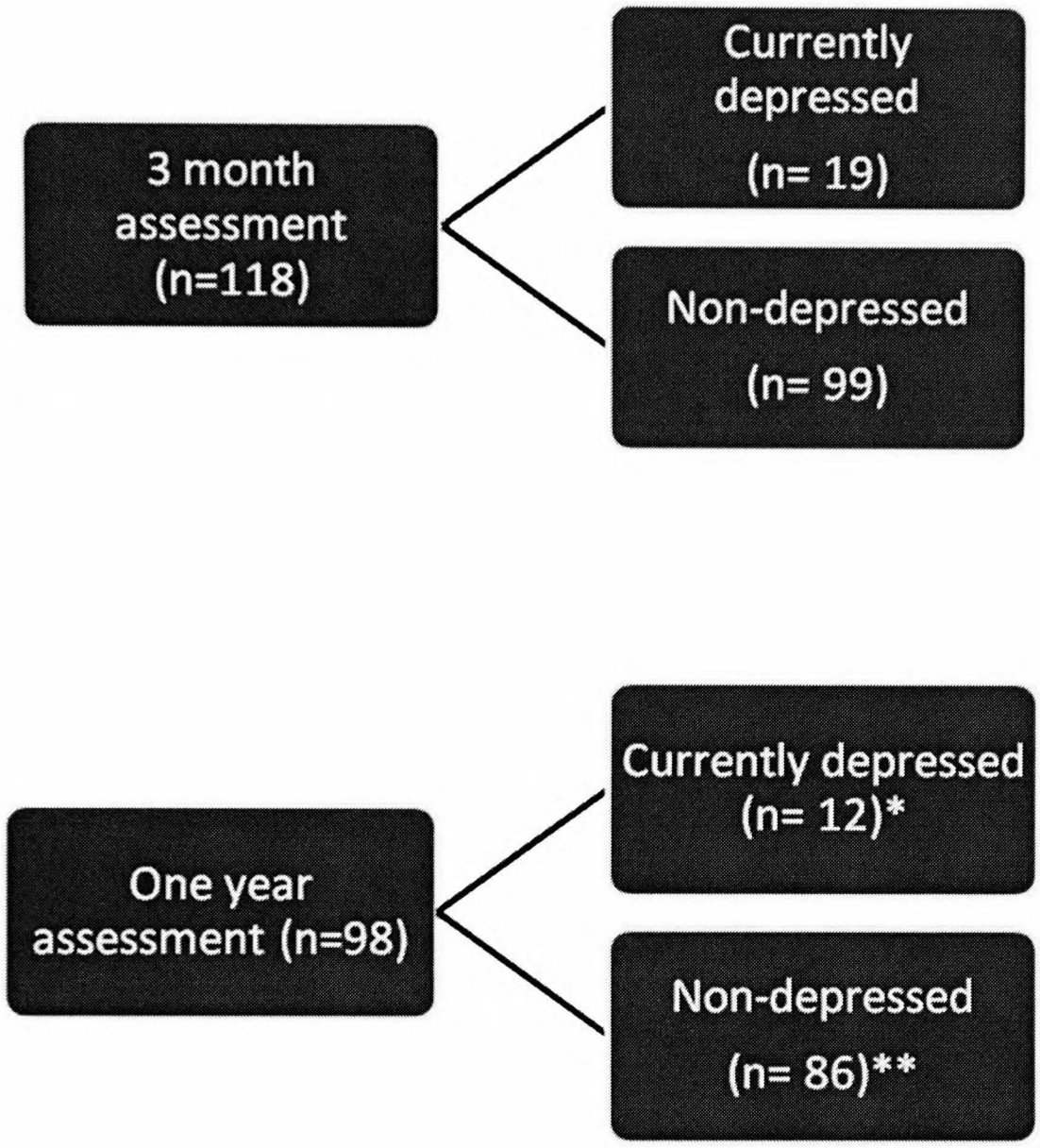
6.5.1 Participants

Participants included, 118 fathers (depressed n=19 and non-depressed n=99) and their infants described in chapter 3. At 1 year follow-up data on 98 families was available and represents the sample for the current study. The decrease in sample size is attributed to: (i) fathers who declined participation at 1 year (n=16) i.e. controls (n= 10) and depressed fathers (n=6) and (ii) fathers whose follow up visits were delayed at the time of writing this chapter (n = 4). At 1 year the sample included 43 male and 55 female infants with a mean age of 14.20 months (*SD*= 1.98). Paternal mean age was 34.82 (*SD* = 5.94), 59% of the sample had acquired a degree or postgraduate qualification and 91% were Caucasian. There were no differences in paternal age, SES and education; infant age and birth order between fathers who were assessed at 1 year and those who refused an assessment.

6.5.2 Procedure

Sample ascertainment is described in Chapter 3, p.78. The three month assessment included observations of father-infant interactions and the SCID was conducted to examine clinical symptoms of depression (Chapter 3, p.84). At 1 year independent reports from mothers and fathers were obtained on child behavioural adjustment.

Figure 6.2. Participant flow from 3-months to 1 year



Note: * 6 depressed fathers were lost to follow-up at one year, 1 depressed father not assessed; ** 12 non-depressed fathers lost to follow-up, 1 non-depressed father not assessed at the time of writing up.

6.5.3 Measures

Paternal depressive symptoms

SCID (described previously in chapter 3, p. 84)

Paternal interactive behaviours

Observational measures of paternal behaviours were coded using the GRS. Factor analyzed dimensions of paternal behaviour in the car seat and floor mat contexts were utilized Chapter 3, *pp*. 96-104.

Maternal sensitivity

The maternal *sensitivity* construct was based on observational scores for, warmth, acceptance, responsiveness, non-demanding and sensitive behaviours on the GRS (L. Murray, Fiori-Cowley et al., 1996). Maternal sensitivity was analysed as a confounding variable, in adjusting for the relationship between paternal interactive behaviours and child outcome.

Child externalizing behaviours (Child Behaviour Checklist, CBCL/ 1½- 5; (Achenbach & Rescorla, 2000)

The CBCL, a component of the Achenbach System of Empirically Based Assessment (ASEBA) is a parent-report measure of children's behaviour. The CBCL comprises two broad groupings of syndromes namely internalizing and externalizing. The current study utilized the externalizing grouping which comprised 'problems that mainly involve conflicts with other people and with their expectations for the

child' (*p.*13). Both mothers and fathers rated their child's behaviour as they are 'now or within the past two months' on a three point scale (0 *not true*, 1 *somewhat true* and 2 *very true or often true*). 31 items constitute the scale's broadband externalizing problem syndrome, subdivided into Oppositional (17 items), Aggressive (9 items) and Overactive (5 items) scales *(Appendix 6A, p.415)*. The broadband externalizing score and individual items constituting subscales were identified in a Dutch population of 2-3 year olds (Koot et al., 1997) and subsequently reported in a sample of 12 month old infants (van Zeijl et al., 2006). This scale has been validated for use in children as young as 12 months (van Zeijl et al., 2006) and good reliability and validity of the scale have been reported by Koot et al., (1997).

6.6 Analytic strategy

The first step of the investigation comprises preliminary analyses which include descriptive statistics on: (i) the independent variable; depressive symptoms on the EPDS and the SCID, (ii) the dependent variable; both maternal and paternal ratings on the CBCL and (iii) infant gender differences in paternal depressive symptoms and child externalizing behaviours.

The second step of the analyses explores the association and subsequent prediction from paternal interactions to child outcome and includes the following stages: (i) intercorrelations between observed paternal behaviours in the car seat context[17] and child outcome, (ii) intercorrelations between observed paternal behaviours in the

[17] Paternal behaviours include Factor analysed scores on the GRS (Chapter 3, p. 96)

floor mat context[18] and child outcome, (iii) step wise regression analyses are conducted to test the direct prediction of child outcome from paternal engagement controlling for paternal demographic characteristics (age and education), observed measures of maternal sensitivity and infant reactivity (fretfulness). In the first step the independent prediction of externalizing problems from paternal behaviours is examined. Next demographic variables are included, followed by maternal sensitivity and infant fretfulness.

The third step of the analyses follows Baron and Kenny's (1986) guidelines for testing mediational models. A series of hierarchical regressions tested the mediating role of paternal engagement in the relation between paternal depressive symptoms and child externalizing problems. Individual models were tested for each mediational pathway. Preceding these analyses bivariate correlations were conducted between a continuous measure of paternal depressive symptoms (EPDS) and outcome and *t*-tests were used to analyze difference in child outcome based on a categorical measure of paternal depression (SCID). Both these measures were used as it is recognized that subthreshold depressive symptoms can be clinically important.

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[18] Paternal behaviours include Factor analysed scores on the GRS (Chapter 3, p. 101)

6.7 Results

6.7.1 Preliminary analyses

Paternal depressive symptoms

At seven weeks, EPDS scores ranged from 0 to 20 (*M*= 5.68, *SD*= 4.62). For 13.6% of the fathers, depressive symptoms fell at or above 10 on the EPDS. Of the total sample (n= 118); 19 fathers were diagnosed as being depressed using the SCID and 99 fathers fell in the non-depressed category at 3 months.

Child externalizing behaviours

T scores on maternal reports of the child's externalizing total problem score on the CBCL ranged from 0 to 34 (*M*= 12.48, *SD*= 7.68). Paternal reports were similar, ranging from 0 to 37 on the total externalizing problem subscale (*M*= 13.17, *SD*= 7.43). There were no differences in maternal and paternal reports of child externalizing problems *(Appendix 6C, p.417)*. In subsequent analyses, maternal ratings on the CBCL are utilized. The rationale for using this methodology was to avoid same-source bias, i.e. paternal reported depression and child behaviour and to reduce the risk of biased reporting by depressed fathers.

Child gender

There were no significant differences across males and females on paternal EPDS scores, and child externalizing behaviours *(Appendix 6D-6E, pp.417-418)*. Subsequently gender is not included in any further analyses.

6.7.2 Main analyses

6.7.2.1 Paternal interactive behaviours and child outcome

Bivariate correlations between paternal behaviours in the car seat context and child outcome (Table 6.1)

Results indicate a negative association between sensitivity and overactive child behaviours rated by mothers (r = -.21, *p*=.041); implying that children of fathers who were *cold, rejecting and demanding* in their interactions at 3 months were more likely to show overactive behaviours when they reached 1 year. There was no evidence of any other associations seen.

Table 6.1. Correlations between paternal behaviours and ***mother rated*** child outcome
(Car seat context; n= 97)

Factor analysed scales	Oppositional behaviours	Aggressive behaviours	Overactive behaviours	Externalizing total score
Paternal behaviours*				
Engagement	-.06 *(p= .582)*	-.11 *(p=.268)*	.02*(p= .848)*	-.06 *(p= .553)*
Responsiveness	-.08 *(p=.445)*	.03 *(p=.776)*	-.05 (p= .611)	-.06 *(p= .554)*
Sensitivity	.04 *(p=.700)*	-.12 *(p= .239)*	**-.21 *(p= .041)***	-.06 *(p= .589)*

Note: Significant correlations are in bold; * Factor analysed behaviours coded using the GRS

Bivariate correlations between paternal behaviours in the floor mat context and child outcome (Table 6.2)

There was consistent evidence of an inverse association between paternal engagement and mother rated oppositional (r = -.24, *p*=.023), aggressive (r = -.31, *p*= .003) and overactive scales (r = -.23, *p*=.026) as well as with the total externalizing

score (r = -.30, p=.004) of the CBCL. Fathers who were *remote, withdrawn, silent (i.e. disengaged)* in their early interactions were consistently more likely to have children display externalizing behaviours at 1 year. There was no evidence of an association with externalizing behaviours for the responsive and sensitive factors.

Table 6.2. Correlations between paternal interactive behaviours and ***mother rated*** child outcome ***(Floor mat context; n=92)***

Factor analysed scales	Oppositional behaviours	Aggressive behaviours	Overactive behaviours	Externalizing total score
Father behaviours*				
Engagement	**-.24 *(p=.023)***	**-.31 *(p=.003)***	**-.23 *(p=.026)***	**-.30 *(p=.004)***
Infant directive responsiveness	.01 *(p=.908)*	.06 *(p=.563)*	.02 *(p= .884)*	.03 *(p= .799)*
Sensitivity	.00 *(p= .967)*	-.12*(p=.262)*	-.13 *(p= .234)*	-.06 *(p= .587)*

Note: Significant correlations are in bold; * Factor analysed behaviours coded using the GRS

6.7.2.2 Predicting child outcome from paternal engagement

As predicted decreased paternal engagement during father-infant interactions predicted externalizing symptoms (β = -.34, p= .001) and explained 11.4 % of the variance in child outcome (Table 6.3, p. 237). To test whether this relationship could be explained by paternal demographic features, maternal sensitivity and infant fretfulness; regression analysis was repeated controlling for these variables. Paternal engagement continued to predict externalizing symptoms (β = -.37, p= .000) over and above the maternal influence and the influence of infant reactivity.

Table 6.3 Regression analysis predicting child externalizing behaviours from *paternal engagement (N=87)*

	Dependent variable: Externalizing symptoms			
Variable	**B**	***SE* B**	**β**	***p***
Step 1 F (1, 87) = 11.11, *p*= .001				
Paternal engagement	-2.44	.73	-.34	.001
Step 2 F (3, 87) = 11.98, *p*= .000				
Paternal engagement	-2.76	.66	-.38	.000
Paternal education	1.96	.78	.23	.013
Paternal Age	-.44	.11	-.36	.000
Step 3 F (4, 87) = 8.93, *p*= .000				
Paternal engagement	-2.80	.67	-.39	.000
Paternal education	1.88	.80	.22	.023
Paternal Age	-.45	.12	-.37	.000
Maternal sensitivity	.43	1.11	.037	.701
Step 4 F (5, 87) = 8.16, *p*= .000				
Paternal engagement	-2.65	.67	-.37	.000
Paternal education	1.59	.81	.19	.053
Paternal Age	-.43	.11	-.35	.000
Maternal sensitivity	.77	1.10	.07	.486
Infant reactivity (i.e. fretfulness)	1.66	.85	.18	.053

Note. R^2 = .114 for step 1; ΔR^2 = .186 for step 2; ΔR^2 = .001 for step 3; ΔR^2 = .031 for step 4

6.7.2.3 The mediating role of paternal engagement in the relationship between father's depressive symptoms and maternal report of externalizing symptoms

A continuous measure of depression (EPDS) and child outcome (Table 6.4)

There was evidence of an association between paternal scores on the EPDS and maternal reports of child externalizing behaviours.

Table 6.4 Correlations between depressive symptoms (EPDS scores)[1] and externalizing behaviours *(n= 97)*

EPDS	Oppositional behaviours	Aggressive behaviours	Overactive behaviours	Externalizing total score
Maternal CBCL ratings				
EPDS	.20 *(p= .050)*	.09 *(p= .366)*	**.23** *(p= .022)*	**.22** *(p= .030)*

Note: EPDS = Edinburgh Postnatal Depression Scale; [1] Paternal EPDS measured 7-weeks post-birth

Categorical measures of depressive symptoms (SCID) and child outcome (Table 6.5)

Using a categorical measure of depression there was no evidence of an association with child externalizing problems.

Table 6.5 Mean scores on externalizing behaviours in children of depressed and non-depressed fathers[1]

	Depressed (n= 12)		**Non -depressed (n= 86)**			
CBCL scores	Mean	*(SD)*	Mean	*(SD)*	*t*	*p-value*
Maternal ratings						
Oppositional behaviour	8.08	5.65	8.13	5.30	-.03	.976
Aggressive behaviour	1.42	2.11	1.60	1.82	-.27	.789
Overactive behaviour	3.00	1.65	2.78	2.05	.36	.722
Total externalizing score	12.50	7.90	12.48	7.69	.01	.994

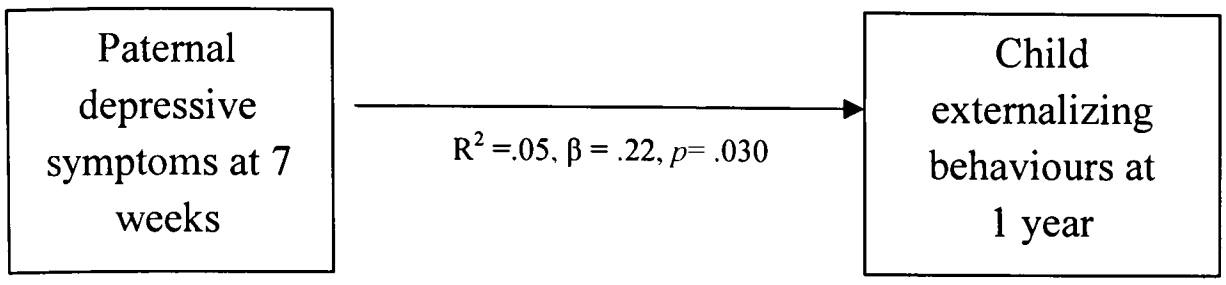
Note: [1]Depression measured using the SCID

Mediation model

Having identified an association between a continuous measure of depression using the EPDS and total externalizing ratings on the CBCL, the mediating role of paternal interactive behaviours is subsequently examined.

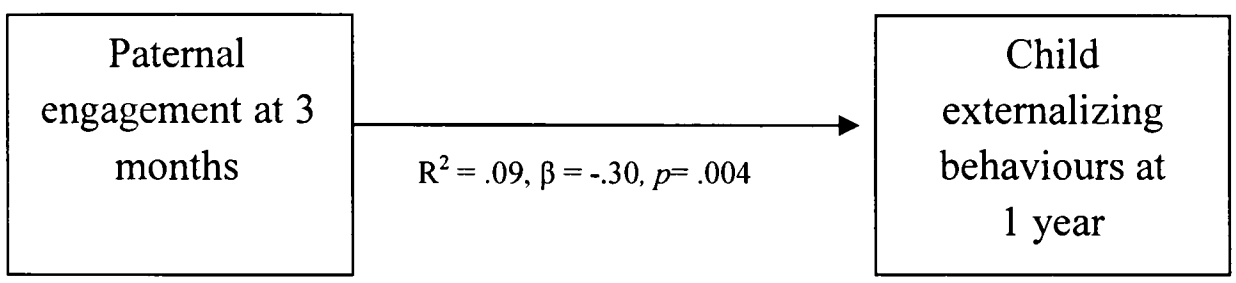
Empirical support for mediation requires four steps (Baron and Kenny, 1986): (i) depressive symptoms significantly predict externalizing behaviours, (ii) paternal engagement significantly predicts externalizing behaviours, (iii) depressive symptoms significantly predict engagement and finally (iv) when engagement is added to the equation, the prediction between depressive symptoms and externalizing behaviours is no longer significant.

Step 1



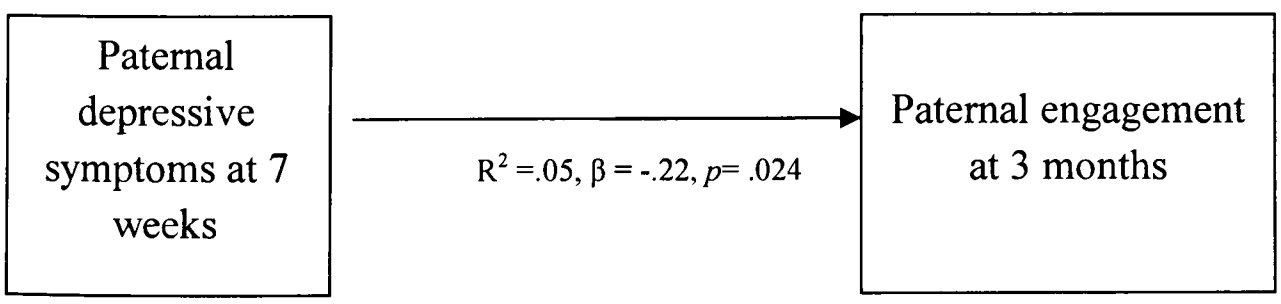
For step 1, regression results indicate that fathers with higher depressive symptoms at 7 weeks have infants with increased externalizing behaviours at 1 year, F (1, 96) = 4.88, *p*= .030.

Step 2



For step 2, fathers who are less engaging have infants display increased externalizing behaviours at 1 year, F (1, 91) = 8.72, *p*= .004

Step 3



For step 3, fathers who experienced more depressive symptoms participate in fewer episodes of engagement during face to face interactions at 3 months, F (1,105) = 5.23, *p*= .024.

Step 4

Statistically controlling for shared associations with paternal engagement, the association between paternal depressive symptoms and total scores for child externalizing problems was no longer significant (β = .15, p= .150). Thus there was evidence of mediation (Figure 6.2) by paternal engagement, on the association between father's depressive symptoms and maternal reported externalizing symptoms according to Baron and Kenny Criteria; with a fall in β value (from .22 to .15). It should be noted that when the reverse process was conducted, engagement entered first and depressive symptoms second; the same results were obtained; engagement remained a significant discriminator of externalizing behaviours but depressive symptoms did not. Because the R^2 for depressive symptoms does not drop to a zero value, it cannot be concluded that engagement completely mediates the association; however evidence of partial mediation is present.

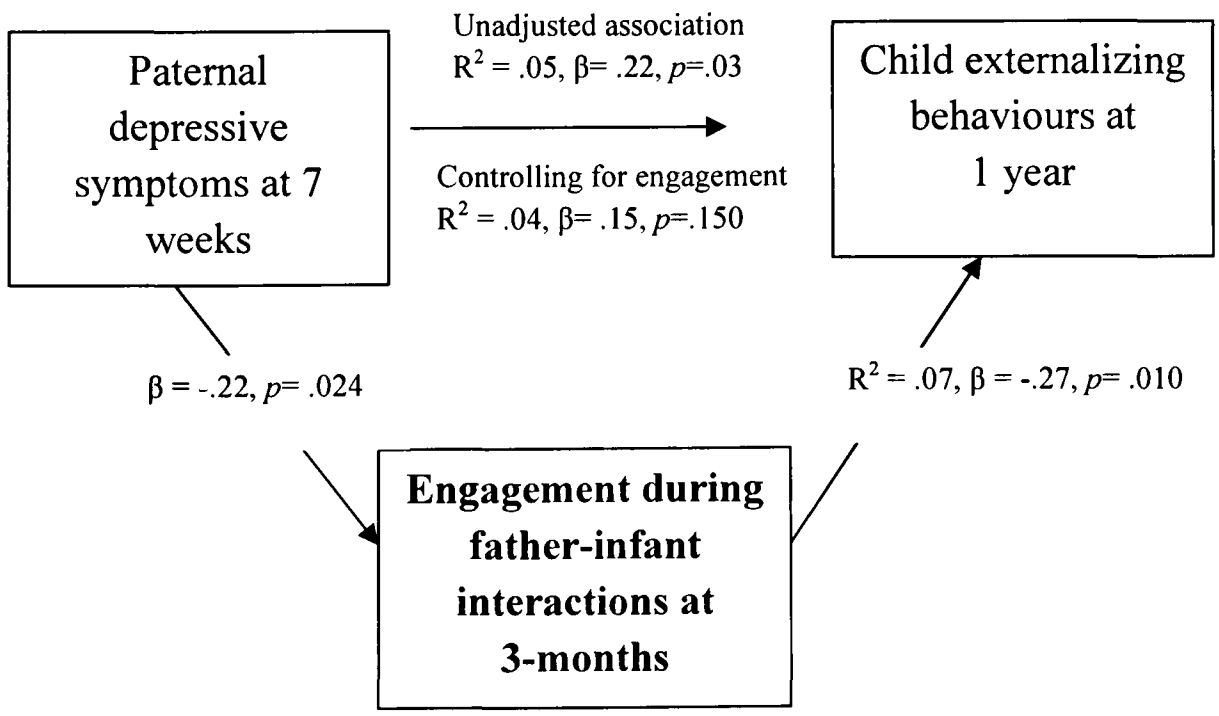


Figure 6.3. Engagement during father-infant interactions at 3 months as a mediator of the relationship between paternal depressive symptoms and child behaviour (n=90); values are standardised regression coefficients (β).

Similar models of mediation for oppositional and overactive subscales were explored based on earlier results indicating an association between EPDS scores and these subscales; r = .20, *p*=.050 and r = .23, *p*= .022 respectively.

In the first of the two models, (Figure 6.3) paternal depression was marginally associated with oppositional behaviours (β = .201, *p*= .050). When including paternal engagement in the model, the beta value drops to .148 and the resulting *p*- value of .165, indicates evidence of mediation according to Baron and Kenny criteria. The final model including engagement was significant F (2, 90) = 3.97, *p*= .022.

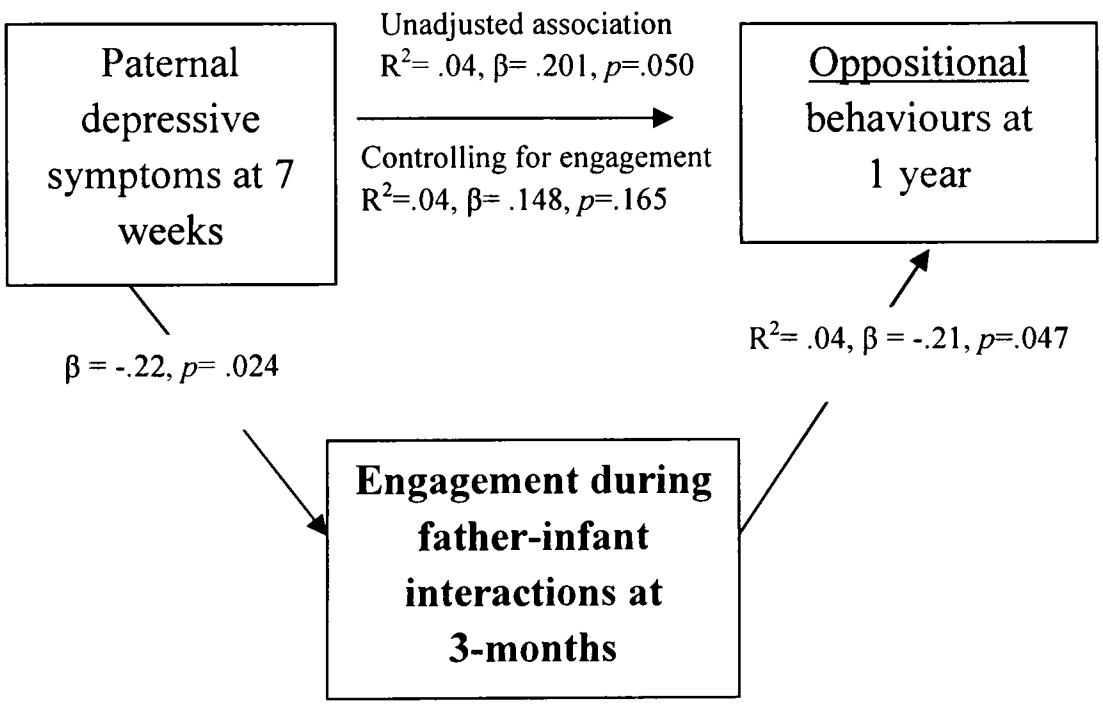


Figure 6.4. Engagement during father-infant interactions at 3 months as a mediator of the relationship between paternal depressive symptoms and oppositional behaviour (n=90); values are standardised regression coefficients (β).

In the second model (Figure 6.4) increased scores on the EPDS were associated with higher scores for overactive behaviour on the CBCL (β= .21, *p*=.048) and explained 4.3% of the variance. In controlling for paternal engagement; the drop in the beta coefficient (β= .16) and resulting *p*-value (.141) indicate partial evidence of mediation according to the Baron and Kenny criteria. The final model was significant, F (2, 90) = 3.92, *p*= .023.

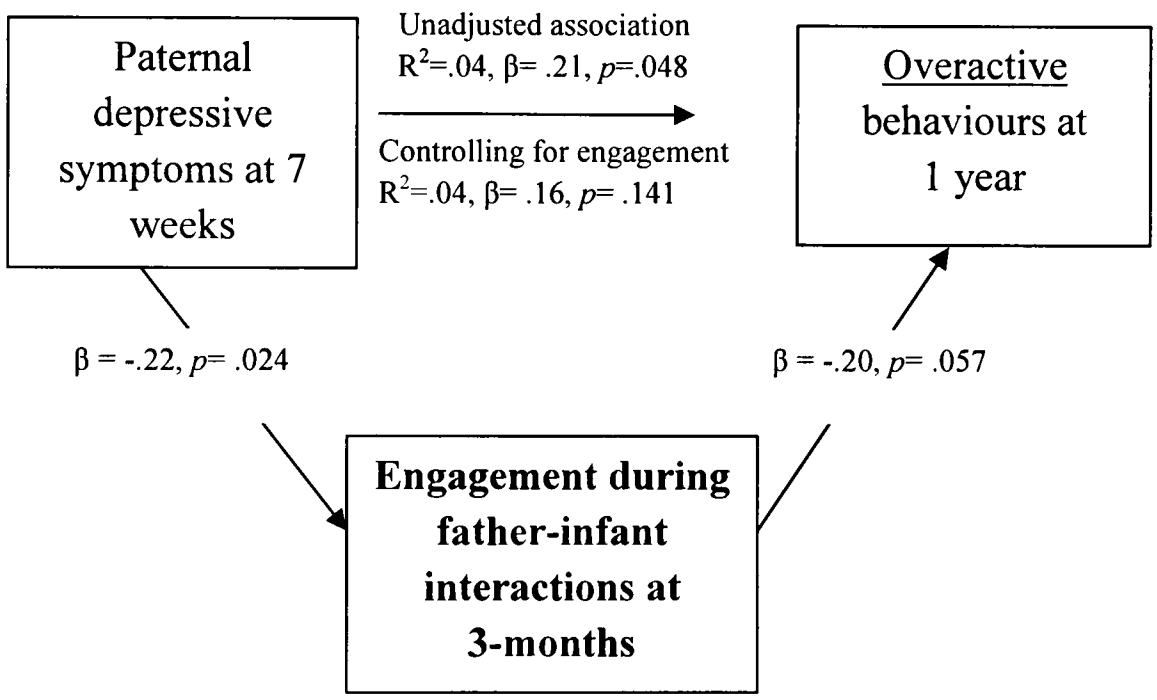


Figure 6.5. Engagement during father-infant interactions at 3 months as a mediator of the relationship between paternal depressive symptoms and overactive behaviour (n=90); values are standardised regression coefficients (β).

6.8 Discussion

The main aim of this longitudinal investigation was to study a potential mediator i.e. observed paternal behaviour in the context of father-infant interactions at 3-months; on the association between depression in fathers and maternal ratings of child externalizing behaviours on the CBCL at 1 year. Additionally, the independent prediction of externalizing problems from observed paternal behaviour was tested controlling for maternal sensitivity and infant fretfulness. The study breaks new ground in examining the above associations in fathers in early infancy.

The results indicate: (i) decreased paternal engagement predicts more behavioural difficulties at 1 year after adjusting for paternal age and education and maternal sensitivity and (ii) the association between paternal depression and child externalizing was mediated by paternal engagement.

6.8.1 Paternal interactive behaviours and child outcome

The prediction that decreased paternal engagement during father-infant interactions at three months predicts increased externalizing problems at 1 year was supported. The results suggest that fathers who were less engaging; defined as being less energetic, less physically and psychologically involved, less verbal with decreased displays of happy affect; had infants who were more likely to display oppositional, aggressive and overactive behaviours. Since there are no prior studies on this association in infancy; the results are comparable to: (i) studies conducted in early childhood (DeKlyen, Biernbaum, Speltz, & Greenberg, 1998; Denham et al., 2000; Pettit & Bates, 1989), (ii) findings reported previously on adolescents (Gray & Steinberg, 1999), (iii) studies on low paternal involvement in clinic referred boys and the development of anti-social behaviour (Baker & Heller, 1996), (iv) the association

between positive engagement and low externalizing scores in a community sample (Mosley & Thomson, 1995) and (v) to the maternal literature (Zahn-Waxler, Lannotti, & Cummings, 1990). Overall, these studies suggest that 'proactive parenting', providing a child-centred, structured environment in early childhood and parental monitoring, involvement and paternal positive involvement in later childhood and adolescence decrease children's externalizing problems.

Why does disengaged parenting place the child at risk for behaviour problems?

A possible explanation for the above findings is that a disengaged pattern of parenting fails to provide clear rules, regulations and a structure for the infant; in the absence of an appropriate interactive framework infants maybe more likely to gain paternal attention and involvement through dysfunctional behaviours. From a social learning perspective proposed by Patterson, DeBaryshe and Ramsey (1989) in a *coercion model*; behaviour difficulties are in effect a means of social adaptation used to change paternal behaviour over time. Alternatively fathers may tend to disengage themselves from a temperamentally difficult infant; hence lack of appropriate stimulation or the opportunity to regulate emotion may increase the risk of behavioural difficulties. A related explanation can be drawn from the maternal literature on the association between maternal rejection and externalizing problems (Shaw et al., 1998). In the current context decreased engagement, may result in explicit remoteness (silence, physical and psychological withdrawal) but may implicitly involve lack of positive affect and contingent care giving (sadness, lack of initiative and energy). Hence according to the social learning perspective, remote interactions might inadvertently reinforce the child's problem behaviours by attending to negative expressions. As suggested above the child might learn that the only way to stop paternal non-contingent withdrawal is to behave aversively;

conversely positive engagement may lower the risk of behaviour problems because the child is positively reinforced and thus has a lower need for attention. Furthermore, children who are not positively stimulated and reinforced may fail to internalize moral values and social norms and are at an increased risk of behaviour difficulties.

6.8.2 The mediating role of paternal engagement in the relationship between father's depressive symptoms and maternal report of externalizing symptoms

The hypothesis on the mediation model; paternal engagement mediating the relationship between depressive symptoms and child outcome was supported. Results confirm previous findings on the association between paternal depression and child behavioural difficulties in infancy (Carro et al., 1993; Ramchandani et al., 2005). The finding that father's depressive symptoms are associated with children's externalizing problems indirectly through paternal engagement is also consistent with previous research (Conger, Patterson, & Ge, 1995; F. J. Elgar et al., 2007; Kane & Garber, 2009; Low & Stocker, 2005).

Understanding the mechanism of transmission

Engagement studied in the current context can be mapped onto one of three domains[19] of parenting, i.e. 'positive involvement' which has been linked to the onset of early conduct problems (Loeber & Dishion, 1983). There is sufficient evidence to suggest that the impact of depression is evident in an interpersonal context. Moreover a cognitively stimulating and supportive early environment places the

[19] The other two dimensions include: parent-child conflict and parental monitoring.

child on a developmental trajectory of increasing competence. In linking the above three aspects we can speculate that children of depressed fathers who lack the appropriate stimulation (verbal, facial, emotional, psychological) fail to develop the appropriate skills to engage in adaptive behaviours. Paternal withdrawal may result in the child 'acting out' in order to gain the parent's attention. The depressed father being more sensitive to negative aspects of his environment may respond to the child's 'acting out' negatively. This cycle of behaviour initiated within the context of early interactions may later develop into maladaptive behavioural strategies. In contrast stimulating and warm communication, reflected in the positive engagement of non-depressed fathers may help the child to regulate emotions within a secure environment; cognitively interpret the episodes of interactive exchange and internalize parental messages. The child may subsequently express adaptive behaviour strategies in response to positive parenting.

An additional explanation of the model includes another aspect of family relationships i.e. marital functioning. Perhaps depressed fathers, who experience dysfunctional marital relationships tend to disengage from the child; reflecting a spill-over effect from one relationship to the next. Future research should explore marital functioning and its impact on parenting and subsequent child outcome. At the same time it is also important to note that genetic factors may play an important role in the intergenerational transmission of risk, which was not investigated in the current study. However the combination of genetic vulnerability coupled with decreased engagement may predict worse outcome, as previous research indicates that parents of disruptive children who are able to cognitively facilitate their child may increase the child's adaptive tendencies (Gartstein & Fagot, 2003).

6.9 Strengths and Limitations

The present study capitalized on a longitudinal design involving independent informants. In utilizing both self report and interview measures of paternal depression and maternal reports on child outcome a potential confound was avoided i.e. reporter bias; inherent in having fathers rate both their own symptoms and child outcome (Achenbach, McConaughy, & Howell, 1987). Observational measures of father-infant interactions rather than parent-reported questionnaires were utilized. Studies have reported that observational data tend to show higher estimates of the role of the environment on the association between parental and offspring behaviour than those obtained using parental ratings (Deater-Deckard, 2000). Examining paternal behaviours during early infancy is advantageous as the number of social interactive contexts which might potentially impact on the child's adjustment is fairly limited.

The findings need to be interpreted in the light of the following limitations. First, the participants were primarily white, middle-class; well educated therefore the findings may not be applicable to families experiencing economic hardship or those from other cultures. Second, the study included a relatively short term predictive time period hence conclusions about the trajectories of externalizing problems need to be interpreted with caution. Third, the results need to be considered with caution as one cannot easily disentangle at this stage temperament characteristics from more specific behaviour difficulties. Fourth, an important limitation in testing the mediational models was the decrease in participants (particularly depressed fathers) during follow-up and the low power of the study. The rate of attrition in the total

sample at one year was 16.94%. There were no differences in paternal age, SES and education and infant age and birth-order between fathers assessed at 1 year and those who refused an assessment. With a small group of depressed fathers (n=12) there was no evidence of an association between a categorical measure of depression (SCID) and child externalizing problems. The small sample size meant limited power, which was particularly problematic in the investigation of the mediating role of father-infant interactions in explaining the association between paternal depression (fathers meeting research diagnostic criteria on the SCID) and child externalizing problems. However a mediational model was constructed using a sample of 97 participants following evidence of an association between EPDS scores at 7 weeks and maternal ratings on the CBCL at 1 year follow-up. The implications of the small number of depressed fathers are discussed in further detail in the next chapter.

6.10 Implications

This study highlights a potential target of intervention with regards to fathers which may help to reduce the prevalence of behaviour problems. This research also indicates that signs of child behaviour problems are evident as early as 1 year and hence preventive interventions that target infants and their families and those that screen for high risk children can be developed.

6.11 Conclusion

In summary the current study found that depressive symptoms were associated with externalizing problems through early father-infant interactions. These results highlight the importance of studying pathways of risk in fathers and restate the important role of early-father infant interactions.

Chapter 7: Discussion

7.1 Thesis aims and main findings

The main aims of this thesis include: (i) an examination of the influence of depression in the postnatal period on early father-infant interactions and (ii) whether these father-child interactions are a potential pathway, in explaining an association between paternal depressive symptoms at three months and later child externalizing problems.

As a first step, a systematic review was conducted examining the father's unique contribution to child development, through longitudinal studies that examined the association between early observational measures of paternal sensitivity and later child behavioural and cognitive difficulties *(chapter 2)*.

Next, the influence of paternal depression on early interactive behaviours was examined in the following ways: (i) using the GRS a well-validated instrument, originally developed to study mother-infant face to face interactions *(chapter 3)*, (ii) using the P-PATS, a new tool developed in the context of the current study, to address behaviours more representative of the paternal repertoire (*Chapter 4)* and (iii) using the P-CAMS, the influence of paternal depression on cognitive and mentalizing structures in paternal speech was examined *(Chapter 5).*

Finally, the mediating role of paternal behaviours on the association between paternal depressive symptoms and later child externalizing problems was investigated *(Chapter 6)*.

Chapter 2 verifies the important role of observed father-infant interactions and supports their investigation in the context of depression, in subsequent chapters. Findings also reveal that there are very few studies (n=11), on the relationship between observed paternal sensitivity during father-infant interactions across the first two years and children's development measured prospectively. The findings regarding the relationship between paternal sensitivity and both externalizing and cognitive outcomes were mixed. Paternal sensitivity was consistently associated with both receptive and expressive language skills in toddlerhood and the pre-school years.

Findings from Chapter 3 suggest that paternal depression did not impact on the quality of father-infant interactions in both the car seat and the floor mat interactive contexts, as assessed using the GRS. More specifically depression did not predict impaired paternal behaviours (decreased sensitivity, displays of negative affect and withdrawal) or infant behaviours (decreased positive communication and displays of negative affect).

Findings from Chapter 4 indicate that when the focus of measurement is broadened to include more specific paternal behaviours, depressed fathers engaged in less gentle touch, fewer episodes of excitatory arousal and decreased active engagement compared to non-depressed fathers. There was no evidence of a difference in synchronicity of smiles and physical play in the two study groups.

Findings from chapter 5 show that depression impacts on attentional focus and attributional style in paternal speech. With respect to cognitive biases, depressed father's speech was more self-focused rather than infant-focused and they expressed more negativity about themselves and their infants compared to non-depressed

fathers. Further, the combination of a depressed father and fretful infant led to increased negativity directed at the infant, as opposed to a non-depressed/non-fretful group. Depressed and non-depressed fathers did not differ in their use of mentalizing statements.

Findings from chapter 6 illustrate that paternal engagement during father-infant interactions was a potential pathway in explaining an association between paternal depressive symptoms and externalizing problems in the child. In the course of testing this mediational model, results also suggest that decreased paternal engagement (communication of low-energy levels; remote, withdrawn verbal and non-verbal behaviours and negative affect) was an independent predictor of increased externalizing problems; after controlling for paternal demographic characteristics, maternal sensitivity and infant reactivity i.e. fretful temperament.

In the remainder of this chapter the limitations and strengths of the methodology are considered, followed by a discussion of the findings of this thesis in relation to the wider paternal literature. Next, clinical implications are discussed and suggestions for future research are summarized.

7.2 Limitations and strengths

Although this thesis represents an important and novel attempt at investigating the father's contribution to their child's early social environment and subsequent functioning; several limitations must be acknowledged.

First, the results of the thesis are based on a small sample of currently depressed fathers (n=19) compared to non-depressed fathers (n=99) and hence caution must be exercised in interpreting the results. One may argue that the number of depressed fathers is small for performing many analyses with sufficient statistical power. This argument may support the lack of statistical significance for some findings but should shed no uncertainty on the significant results. The small sample indicates that in addition to directly recruiting fathers from two different research sites and organizing evening and weekend home-based assessments, additional practical steps (addressed below p.265) may necessitate the engagement of depressed fathers in research.

Second, the videotaped interactions on which the assessments of father-child interactions were based were brief. While three minutes (Lundy, 2002b) or shorter durations (R. Feldman et al., 1999; T. M. Field, 1978; T. M. Field et al., 1999b) have been used in previous research, the short interactional sequence may represent unstable estimates of behaviour. However the two interactional contexts, albeit on the same day, provide some evidence of stable, naturalistic functioning. Further research with more extended home observations across multiple-time points may be necessary to validate the findings.

Third, the exploratory nature of the investigations in chapters 4 and 5 require that caution is exercised in interpreting and generalizing the findings, prior to replication on a larger sample. However differences in means between the two groups were consistently in the expected direction.

Fourth, the findings cannot be interpreted in the light of chronic vs. transient effects of depression. The maternal literature provides evidence for increased impairments

with prolonged episodes of depression (Cohn et al., 1990) and researchers indicate that chronicity is as important as diagnostic status alone (Sameroff, Seifer, & Zax, 1982). Parallel conclusions cannot be drawn from the current data.

Fifth, although the OFP included a community sample, the ethnic and socio-economic composition of the participants is a limitation when findings are generalized. By including primarily white, middle class families, it remains unclear whether results are relevant to disadvantaged populations and other ethnic or cultural groups. However, the homogeneity of the sample may have been favourable in that it limited the number of intervening factors like socio-economic risk and adverse family contexts. Further, in this relatively high-functioning sample of older depressed fathers; the impact of depression may have been masked by the motivation to parent positively. However, the findings of an association between paternal depressive symptoms, engagement and externalizing behaviours are noteworthy.

Sixth, an important limitation of the study is the small number of currently depressed fathers at both 3 months and at the one year follow-up. The null findings may reflect a lack of power as the results are based on a small sample of currently depressed fathers (n=19) compared to non-depressed fathers (n=99) and hence caution must be exercised in their interpretation. One may argue that the number of depressed fathers is small for performing many analyses with sufficient statistical power. This argument may support the current null findings but should shed no uncertainty on the significant results. At one year the number of depressed fathers dropped to 12 which is a limitation and hence findings on the mediational analysis must be regarded as preliminary. The small sample indicates that in addition to directly recruiting fathers from two different research sites and organizing evening and weekend home-based

assessments, additional practical steps may necessitate the engagement of depressed fathers in research.

A further limitation is based on the observational measures employed. The videotaped interactions on which the assessments of father-child interactions were based were three minutes. While three minutes (Lundy, 2002b) or shorter durations (R. Feldman et al., 1999; T. M. Field, 1978; T. M. Field et al., 1999b) have been used in previous research, the short interactional sequence may represent unstable estimates of behaviour. Some researchers argue that 'for some individuals the event of interest never happens during the observational period' (Stoolmiller, Eddy, & Reid, 2000, p. 298) or may not represent naturalistic functioning. In the current context three minutes were deemed adequate because (i) prior studies have used three minute observational sessions with infants and applying a similar time frame would help in comparability across studies, (ii) in the piloting phase three minutes did not result in infant fatigue and (iii) in increasing the time to five minutes (previously employed in face to face mother-infant interactions, (L. Murray, Fiori-Cowley et al., 1996) the latter two minutes of interaction did not reveal a different behavioural sequence; rather most parents continued to engage in a similar pattern to that observed in the earlier part of the interaction. Further research with more extended home observations across multiple-time points may be necessary to validate the findings.

Finally, The P-PATS and the P-CAMS used to measure more specific paternal behaviour and paternal speech respectively; were developed on a sub-sample of depressed and non-depressed fathers from the OFP. The new systems were subsequently tested for likely group differences on a sample of non-depressed fathers from the larger study (who were not part of the development stage) and a few

depressed fathers (n= 4; who were part of the development stage).This may lead to questions about the validity of the measure and is an important limitation to be addressed. Further validation on a new sample is essential to test the discriminative validity of the scales and until then caution may be exercised in drawing definitive conclusions from the preliminary findings in this thesis.

Though several limitations exist, this thesis makes an important contribution by examining an aspect of family functioning that has been previously underrepresented, i.e. the impact of paternal pathology on early parenting and subsequent child development. The findings reported in this thesis also suggest that impaired paternal behaviours reported previously as a pathway in older children may also operate in infancy. A major strength of this study is the inclusion and direct observation of fathers themselves, rather than using mothers as a source of paternal data. Other strengths include the utilization of: (i) a clinical measure of depression rather than relying exclusively on self-report symptoms, (ii) direct observational measures for the interpretation of father-infant interactions on different levels (Aspland & Gardner, 2003) *p*. 137) including; 'content' (e.g. analysis of the paternal speech), 'interactional quality', (e.g. warmth, sensitivity), 'frequency of specific behaviours' (e.g. excitatory arousal or tactile stimulation) and 'behavioural contingencies' (e.g. smiles contingent on positive behaviours), (iii) blind coding of interactive behaviours and the inclusion of an additional play setting to facilitate their expression and (iv) longitudinal data obtained from multiple informants in the analyses of a mediational model (i.e. seven week self-report measures of paternal depression, three month observational measures of interaction and twelve month maternal and paternal reports on child externalizing behaviours).

7.3 Specific contribution of the thesis

In chapter 1 of the thesis two research questions were proposed. First, are there differences in the interactions of depressed and non-depressed father- infant pairs? Second, are early father-infant interactions a potential mechanism in explaining the transmission of risk from father to child? In this section the findings are re-examined in relation to the existing literature on paternal research.

7.3.1 Differences in the interactions of depressed and non-depressed fathers

7.3.1.1 Supporting a shift away from the 'mother-template' to the development of a coding scheme for paternal behaviours

'A principal arena for the assessment of the mother-infant relationship in the context of post-partum depression has been the structured face to face interaction', (Murray, Fiori-Cowley, Hooper and Cooper, 1996, *p.* 2512). This thesis utilized both the original face to face context suggested above (i.e. the car seat) and a modified version (i.e. the floor mat context). In the above settings paternal and infant behaviours were unrelated to the father's depressive states in the postnatal period, when observations were coded using the GRS. Similar results have been previously reported during observational measures of interactions in infants aged 3-6 months in participants from both low and high social functioning (T. M. Field et al., 1999b; Forbes et al., 2004; Lundy, 2002b). The results may additionally have indicated; (i) a potential limitation of the face-to-face situation in elucidating the impact of depression on paternal behaviours or (ii) that the GRS measure was not sensitive to

differences in the interactions of depressed and non-depressed fathers. Since weak evidence of decreased engagement by depressed fathers in the face to face floor mat situation was present; we began to question the measure used in the assessment of father-infant interactions rather than the procedure employed to observe them.

In the absence of sufficient observational studies on fathers; researchers working in the area, often resort to the use of available tools previously developed for mothers (Brophy-Herb, 1999; Heermann, Jones, & Wikoff, 1994; Shannon et al., 2002). This thesis indicates that due to the lack of a better alternative, this approach may lead to an inaccurate representation evident in the first set of results on differences between depressed and non-depressed fathers.

A particular challenge involved in coding father-infant interactions using the GRS was that definitions that may have been relevant to guide reliable coding of mother-infant interactions were not as clear when applied to fathers. For example, father's use of touch and engagement in physical activity when in close proximity to the infant would be coded as 'intrusive' using the maternal scheme. However coders felt that fathers engaging in the same behaviours appeared to engage the infant rather than intrude. Mothers displayed warmth and sensitivity by looking at, smiling, vocalizing and responding; fathers appeared to express warmth and sensitivity through game-playing, motor movements and arousal strategies. These findings led us to consider; are we using the right template?

This thesis provides empirical evidence to suggest that there is considerable value in understanding specific paternal behaviours. There are clearly similarities in parent-child play between mothers and fathers and in reality both parents may adopt overlapping roles within the family system (Tamis-LeMonda, 2004). For example,

observational sessions of father-child and mother-child interactions suggest that both parents employ teaching strategies, describing shapes, colours and environmental features; contingently respond to child behaviours and vocalizations and express similarities in utterance length, use of directives, repetitions and adjustments in their speech repertoire (Bornstein et al., 1992; Roggman, Boyce, Cook, Christiansen, & Jones, 2004). However, we also propose that fathers express differential behaviours. They are more likely to engage in energetic limb movement games and unexpected behaviours and vocal gestures to rouse and excite the infant. These behaviours were not identified by the present GRS categories. Hence we conclude from the first set of findings that it would seem premature to advocate that depression does not impact upon early paternal behaviours.

In view of the current findings and the available literature (Bogels & Phares, 2008; Paquette, 2004b; Roggman, 2004; Tamis-LeMonda, 2004), we suggest that exploring the gap in the theoretical understanding of the father's unique contribution may be a preliminary step towards understanding how parents work as a 'dynamic system'; one of interacting partners and overlapping systems (Tamis-LeMonda 2004, Roggman, 2004). Knowledge on more specific dimensions of paternal behaviour may subsequently enable researchers to piece together the complimentary roles that parents share within the family system and progress towards a unified theory. Until then our understanding of the parent-child relationship as a crucial context to early child development will remain unbalanced.

7.3.1.2 The interactive profile of depressed fathers

In an attempt to develop and apply a coding scheme based on behaviours more characteristic of fathers; findings on the impact of depression in the use of gentle

touch, episodes of excitatory arousal and active engagement by fathers, replicate previous results from the paternal literature (McElwain et al., 1999, Paulson et al., 2006, Zaslow et al., 1985).

Further, findings on cognitive biases from the speech study support previous research on attentional focus in depression (Smith and Greenberg, 1981, Ingram et al., 1987, Pyszcynski et al., 1989) and the attributional style of depressed mothers (Murray et al., 1993, Zlochower and Cohn, 1996). These novel findings on fathers suggest that depression leads to increased focus on the self and negativity directed at the self and the infant.

From the above studies the typical interactive profile of a depressed father in early infancy can be described as both *'disengaged'* and *'emotionally negative'*. *Disengagement* comprises both behavioural and verbal dimensions including, excitatory arousal, active engagement and self-focused speech. The disengaged profile is defined by withdrawn behaviours; decreased infant stimulation and increased focus on the self. *Negative emotionality* entails behavioural and verbal features including, tactile stimulation and negative speech. The emotionally negative profile is defined by the communication of negative affect; decreased affection evident through less gentle touch and increased verbal negativity. Important to note is that overt negative interactions were observed only rarely. Group differences were accounted for by relatively lower levels of positive engagement and affect rather than by high levels of negative, rejecting and intrusive behaviours.

Father's play is often described as exhilarating and arousing comprising physical, verbal and psychological stimulation. In the case of depressed fathers, the infant is exposed to quieter, less enlivening behaviours and fathers tend to focus on their own

concerns rather than on the infant's experience and state. Withdrawal, resulting from motivational, cognitive and social deficits linked to depressive symptoms, may additionally lead to or represent wider problems within the family system. Depressed fathers tend to respond to marital conflict by withdrawing from the infant; a spill-over from the maternal relationship. Some find themselves spending more time at work and away from the stress of dealing with a new born. As such these fathers may lack the necessary skills to communicate in the face to face context resulting in decreased engagement. Alternatively, it may be that as early as three months fathers haven't yet had the opportunity afforded to mothers, to form an independent relationship with the child. Hence they would be more likely to retract from challenging situations rather than confront them with increased hostility and control; characteristic patterns that are more representative of depressed father's interactions with older children.

Negative affect was most evident in fewer affectionate tactile and verbal gestures shown by depressed fathers. Touch is a sensory system for eliciting and conveying emotion. The maternal literature suggests that the increased frequency of touch may indicate maternal availability and intent to engage. In fathers, it seems that the quality of touch may provide a medium for the transmission of the father's affective state. As well as through touch fathers might also transmit negative affect verbally, by increased directive speech, corrections and negative descriptions of the infant and their experience. Our data thus suggest that cognitive biases previously studied in relation to mothers are also evident in observed father-infant interactions. It remains unclear whether displays of negative emotions are unique to the particular context of measurement but they help to explain features of paternal interactions influenced by depression.

Different face to face settings may elicit a range of behaviours. Observed behaviours depend on the context of observation, the instructions given to the participant and the nature of the task involved (Aspland and Gardner, 2003). We speculate that the floor mat setting may have provided a situation in which to behave in accord with depressive symptomatology, namely to withdraw from providing physical stimulation whereas the car seat setting may have been more sensitive to cognitive biases, as more demands are placed on the fathers verbal repertoire. Future research conducted in different contexts may help shed light on this issue.

7.3.2 Early father-infant interactions: A pathway of influence

This is the first study as far as we are aware, to examine an association between paternal engagement in early infancy and externalizing behaviours at 1 year. Findings are consistent with previous research conducted in childhood and adolescence, in that decreased paternal engagement was associated with later externalizing problems in the child (Gray & Steinberg, 1999; Pettit & Bates, 1989). The finding that the association between paternal depressive symptoms and children's externalizing problems was partially mediated by paternal engagement is consistent with previous research in older children (Conger et al., 1995; Kane & Garber, 2009).

The results extend previous research in several ways. First, paternal engagement in infancy was associated with externalizing behaviours even when controlling for infant temperament characteristics and this association continued to exist when controlling for maternal sensitivity. Second, whereas earlier samples testing a

mediational model comprised older children and adolescents this study suggests that the associations exist as early as the first year. This reiterates the importance of examining early environmental risk in relation to fathers, since symptoms of depression may be related differentially to their parenting behaviours and may result in different explanations for adverse child outcome (Marchand & Hock, 2003). Third, the study utilized independent and time-lagged ratings of parent and child data; as earlier investigations tend to rely on single informants (typically mothers) when collecting both parental and child symptom profiles.

7.3.3 The challenges encountered

In examining the father's role in early infancy numerous challenges were encountered.

A challenge to researchers studying fathers, particularly in the postnatal period has been the recruitment of depressed fathers. On the OFP, researchers approached postnatal families during their hospitalization to obtain permission to contact them at home thereby reducing the risk of selection bias by screening a large population. However researchers designing future research with depressed postnatal fathers, need to include multiple modes of recruitment. Some options may include; approaching general practice attendees, postal recruitment through primary care (Sherr et al., 2006) or collaborating with antenatal and postnatal groups and other relevant community organizations.

A second challenge concerned the subsequent participation of less than a quarter of those who scored above the cut off on the EPDS. A possible method of increasing

the participation of this group of fathers would be to recruit families in the antenatal period and perhaps place resources in developing contact and building rapport, which might then increase future participation. Another option may involve a preliminary first visit to enhance engagement, introduce the project in a face to face setting and address participant concerns. The more personal the contact, the more likely an individual may accept a research invitation. Some researchers suggest that 'majority of resources should be placed in making contact with the families and establishing rapport, rather than actual data collection' (Cabrera, Tamis-LeMonda, Lamb, & Boller, 1999 p. 12).

A third challenge was the reluctance to share information on depressive symptoms by some fathers, or to verbally mask potential difficulties; in an attempt at positive coping; more so in this group of middle-class families. Men and particularly new fathers may be encouraged to talk about their affective state by initially building rapport, developing trust and showing how their research is relevant to other vulnerable families. Showing families the value in their contribution, through sharing of their experiences is an important part of successful participant inclusion. Other strategies discussed include matching interviewers and target participants by sex, age and race (Horowitz, Ladden, & Moriarty, 2002) but it is uncertain if the approach increases participation.

A fourth challenge relates to the development of a coding system for paternal behaviours and the reliability around father coding. Researchers working with fathers need to share definitions of universal behavioural dimensions within specific contexts; in an attempt to move towards designing a paternal template. An understanding of both overlapping and distinctive paternal behaviours in relation to

the context of measurement and the age of the infant may facilitate an understanding of the father's role in their child's development.

7.4 Clinical implications

The findings from this study have important implications for clinical intervention in several ways.

First, disrupted interactions with fathers pose a risk factor for later child dysfunction as a function of the development of cognitive vulnerability mechanisms. Being exposed to negativity as early as 3-months of age, may predispose children to negative cognitive styles through observation and paternal modelling. A second possibility is that children may develop an attributional style consistent with paternal feedback (corrections/ criticism) or through low parental acceptance and high levels of control.

It is important that clinicians are aware of the risk of depression in new fathers and the possible risks to the developing infant. The timing of exposure to paternal depression is of importance as previous evidence in mothers suggests that infant's are particularly vulnerable to exposure to early depression as their neuro-regulatory mechanisms are developing. Considering the current findings clinicians need to channel adequate resources towards the screening and early identification of depression in both parents. Perhaps it will be sometime before men at risk for depression postnatally will be assisted in routine obstetric care; until then detection

of risk (PND in mothers, low social functioning) and the timely provision of support may help those in need.

Finally, findings from this thesis suggest that early interactions are a potential pathway of risk transmission. While the influence of genetic and biological routes cannot be ruled out; environmental mechanisms such as early interactions are susceptible to change. Intervention at the level of motivating engagement and enhancing positivity may be particularly effective in lessening the environmentally mediated risk to the child. Previous studies with mothers suggest that treating depressive symptoms only is not sufficient to improve the mother-child relationship, and subsequent child outcomes (Forman et al., 2007). Moreover interventions focused on enhancing parent-child interactions in depressed mothers have resulted in a decrease in adverse child outcome (Cicchetti, Rogosch, & Toth, 2000). If similar conclusions exist for fathers; specific interventions targeted at father-infant interactions, in addition to reduction in depressive symptoms might help lessen psycho-social risk in the developing child.

7.5 Future research

Several questions remain for future research.

First, that depression occurs in the context of other risk factors (for example, marital functioning, early parental relationships, low SES, paternal comorbidity, child disability); multiple sources of risk need to be addressed. Particularly relevant to fathers is the impact of marital functioning on their parenting behaviours. Including the wider context within which depression manifests and examining how different

risk factors interact may help distinguish their specific and combined influence on early paternal interactions and subsequent child development.

Second, an examination of the longitudinal impact of depression on father-child interactions, across infancy, childhood and beyond may help elucidate the impact of early paternal depression across development.

Third, particular focus is needed in disentangling the effects on the early interactive environment; of acute episodes of depression from more chronic features. An investigation of the features of depression that may be associated with specific interactional difficulties may also be particularly relevant in relation to fathers; as we learn more about depressive symptoms in men in the postnatal period.

Fourth, building on the findings of this thesis, longitudinal studies examining the developmental trajectories of paternal 'withdrawal' and 'negative emotionality' would be a significant undertaking; in addition to their replication on a larger sample in early infancy. Based on these results it might be difficult to determine exactly which aspect of engagement might have carried the most influence from paternal depressive symptoms to child adjustment, hence future studies need to differentiate between different domains of paternal engagement to identify which behaviours are most important for intervention. The findings regarding paternal negativity in speech appear promising and need to be examined in a larger sample and in relation to child outcome.

Fifth, longitudinal investigations into childhood would help in understanding the prospective impact of early paternal depression on; externalizing behaviours and other psychopathology in older children and whether early father-infant interactions are a potential pathway in explaining increased risk beyond infancy.

7.6 Concluding comments

Postnatal depression is a common mood disorder and has been extensively researched in relation to mothers. Researchers and clinicians are increasingly recognizing the psychological impact of the transition to parenthood in men. This thesis has focused on the role of early parenting by fathers; as a potential pathway by which paternal depression in the postnatal period may lead to adverse child outcome. The studies presented have shown that early observed father-infant interactions play an important role in the child's early development. Depression was shown to impact on paternal engagement and expression of affect. The interactive profile of depressed fathers has been described as *'disengaged'* and *'emotionally negative'*. Some evidence has been provided on the identification of a potential mechanism i.e. paternal engagement in the intergenerational transmission of risk.

The importance of including fathers in research has been demonstrated in that the child's early social and communicative environment extends beyond the maternal influence. Additionally, the studies presented support the development of paternal measures when conducting research on fathers rather than relying exclusively on available tools developed for mothers.

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Appendix for chapter 1

Appendix- 1A

Appendix 1A: Studies examining the influence of paternal depression on father-child interaction

Studies using observational measures of father-child interactions						
Citation & country	**Study design**	**Participants and method of recruitment**	**Measures of depression**	**Measures of interaction**	**Results**	**Limitations**
1. Zaslow et al., 1985 [USA]	Cross-sectional	N=37 families 'Middle-class families'; Low risk sample **Group 1**= No 'blues' (n=14); 7 males: 7: female infants **Group 2**= Presence of 8 full days of blues (n=11); 6: females: 5: males **Infant age**: 2½ – 4 months, **Birth order**: First born infants **Father's mean age**: 32 years **Recruitment**: Childbirth education groups	Paternal 'blues' Four questions as part of a home interview on: 1. The presence of blue 2. Intensity of blues 3. Manifestation of feelings 4. Contributing factors	**Context:** Behavioural home observations at three time points **Length of interaction:** 1 hour **Conditions:** Parent-infant in interaction during usual home routines. **Coding scheme:** Paternal behaviour Family Observation Manual (Pedersen, 1978) **Interaction dimensions:** 1. Distance receptor interaction *(visual, vocal and emotional items)*	There were no significant differences in infant behaviour relating to paternal blues. Depressed fathers (those presenting with 8 or more days of blues) showed diminished proximity with their infants and were involved in less touch behaviours and those reflecting caring for the infant's physical needs. Depressed fathers were also more likely to use less non-verbal vocalisations and focused on their babies less in conversation with a spouse.	1. Sample size 2. Measure of depression, using an interview based method

				2. Contact and stimulation *(touching, holding, vigorous tactile stimulation)* 3. Care-giving *(feeding)* 4. Complex-social stimulation *(object presentation, social play, positive affect)*		
2. Field et al., 1999 [USA]	Cross-sectional	N=80 families 'Low socio-economic status' (N=20 per group, evenly balanced on infant gender) **Group 1**=Depressed fathers **Group 2**= Non-depressed fathers **Group 3**= Depressed mothers **Group 4**= Non-depressed mothers **Infant age**: 3-6 months **Father's mean age:** 23 years **Recruitment:** Hospital developmental follow-up clinic	Beck Depression Inventory (BDI, Beck, 1961) administered postnatally [Read in English to all participants due to limited education]	**Behavioural observation:** Face to face play interactions videotaped for 3 minutes **Coding scheme:** Interaction Rating Scale, (IRS, Field, 1980) **Interaction dimensions:** 1. Infant state (7 items) 2. Paternal behaviour (10 ratings) **Parental interaction style** (Malphurs, 1996): (Intrusive, withdrawn, or positive)	There were no reported differences in the interactions of depressed and non-depressed fathers Infant behaviours were not negatively affected by paternal depression	1.Small sample size 2.Questionnaire measures of depression 3. Wide age range of infants 4. Sample may not be representative of the normal population (being drawn from low socio-economic population) 5. Endorsement of depressive symptoms

3. McElwain et al., 1999. [USA]	Cross-sectional	N=62 families Low risk sample **Infant's age:**12 months (n=31, females) **Birth order:** 46 second-born, 13 third- born, 1 fourth-born, 2 fifth-born **Fathers mean age:** 35.5 **Recruitment:** Local birth announcements and day care-centres	Beck depression inventory (BDI, 1961)	**Context:** Lab based **Conditions of interaction:** 1. Free-play session (15-minutes) 2. An open ended teaching session aimed at teaching the infant three tasks **Interaction dimension:** Intrusiveness *['parent-centered interaction: disregarding the needs and interests of the infant']* **Coding scheme:** Fish, Stifter & Belsky, (1991, 1993)	**Free-play session:** Paternal depression was associated with less intrusive behaviour; fathers were more withdrawn and less involved. **Teaching task session:** Paternal depression was associated with less intrusiveness in the observational context of the teaching task session.	1. Infant effects were not accounted for 2. Families were well-functioning, hence generalizability is precluded 3. Conclusions about clinically depressed families cannot be made by these findings 4. Different associations might exist for parents of first born children
4. Forbes et al., 2004 [USA]	Longitudinal study	N=50 families **Lifetime incidence of depression:** 3 months: 13Mothers, 9 Fathers	Structured Clinical Interview for Axis 1 DSM-IV Disorders (SCID, First et al., 1994)	**Context:** Lab. based **Conditions of face to face interactions:** 1.Normal interaction: 3 min 2. Still-face: 2 min	At three months, infants of parents with history of depression displayed greater negative affect in the still face condition. Lifetime major depressive	1. The numbers of fathers with a history of depression and current symptoms was small; hence a large effect for depression may be

		Current symptoms: 3 months: 1 Mother 6 months: 1 Father Both 3 & 6 months: 1 Father **Infant's age at two time points:** 3 months 6 months **Father's mean age**: 27 years **Recruitment:** Population based sample, originally recruited from high schools in urban and rural districts of Western Oregon.	Standardised self-report measure of depression severity-Centre for Epidemiologic Studies Depression (CESD-D) Scale; Radloff, 1977	**Interaction dimensions:** Normal interaction: 1. Parental affect & 2. Physical play 3. Infant affect Still-face: i. Infant affect **Coding scheme:** Physical play: 'Bouncing the infant' Affective codes: Tronicks monadic phases (Cohn & Tronick, 1987) Izard's Affex system (Izard et al., 1983)	disorder was not related to father's physical play or affect. Current depression was not related to paternal engagement in physical play. Low non-significant correlations were reported between current depressive symptoms and positive affect.	required for differences in father-infant interactions. 2. The demographic characteristics of the sample determined by the use of a population based sample may prevent the generalization of the findings beyond the study.
5. Jacob et al., 1997 [USA]	Cross-sectional	Depressed fathers: n=50 Non-depressed fathers: n=49 **Age of children**: Between 10-18 years **Father's mean age:**	Beck Depression Inventory (BDI 1961) Minnesota Multiphasic Personality	**Context:** Laboratory based **Length:** 15 min **Conditions of interaction:** Problem solving	Paternal depression was related to poor communication with the child evident through decreased positivity and acceptance of the child's behaviour and experience	1.Depression and family communication may require more specific measures of negativity and positivity

		Recruitment: Newspaper advert specifying depressed parents with children between the ages of 10-18 years	Inventory Scale 2 (MMPI, Hathaway & McKinley, 1983) Schedule for Affective Disorder and Schizophrenia (SADS; Spitzer et al., 1978)	discussions of topics identified **Interaction dimension:** 1.Positivity *('agree, approve, accent')* 2.Negativity *('criticize, disagree, put down and negative response')* 3.Problem solving *('describe, question, command, solution')* 4. Congeniality *(humor, smile or laugh and talk)* **Coding scheme:** Marital Interaction Coding System (MICS, Weiss & Summers, 1983)		2. Longitudinal designs may facilitate an understanding of the relationship between depression and family communication
6. Lundy B. 2002 [USA]	Cross-sectional	N=15 families 'Lower-middle Socio-Economic Status' **Infant mean age:** 6.3 months **Father's mean age:** 31.13 years	Centre for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977)	**Context:** Laboratory based **Length of interaction**: 6-minutes **Conditions:** face to face interactions with the infant placed in an infant-seat on the table	Paternal depressive symptoms were unrelated to the quality of father-infant interactions	1.Depression was measured using a 20 item self-report scale 2. The sample size is small

		Recruitment: Through the assistance of local paediatricians, day-care facilities, newspaper advertisements, and parents and infants from the psychology department		**Coding Scheme:** Modification of Belsky, Taylor and Rovine's 1984, procedure. **Interaction dimension:** Synchrony *(A set of three contingent responses between parent and infant)*		

Studies using self-report questionnaire measures of father-infant interaction						
Citation & country	**Study design**	**Participants and method of recruitment**	**Measures of depression**	**Measures of interaction**	**Results**	**Limitations**
5. Edhborg et al., 2005 [Sweden]	Data obtained at 7 weeks and 2 months postpartum	N=106 **Data collection:** First seven days after birth 2 months postpartum	The Blues Questionnaire (Kennerly & Garth, 1987) Edinburgh Postnatal Depression scale (EPDS, Cox et al., 1987)	**Context:** Self-report questionnaire, 25 items rated on a scale of 0-5. Postpartum Bonding Questionnaire (PBQ, Brockington et al., 2001) **Interaction dimensions coded:** 1. Impaired bonding 2. Rejection and anger 3. Anxiety about care 4. Risk of abuse [Unfavourable parent-	Depressive symptoms at 2 months were significantly related to the impaired bonding subscale at one week and seven days postpartum. Thus depressed fathers, who experienced a delay in onset of affection towards their infant, were less likely to form a unique bond with them.	1.High dropout rate from 7 days to 2 months postpartum 2. Rather than using observational measures, paternal reports represented a broader way of relating to childbirth and feelings about the infant rather than particular characteristics of the interaction itself.

				child relationship score]		
6. Paulson et al., 2006 [USA]	Data from the first wave of the Early Childhood Longitudinal Study-Birth Cohort	N=5089 Biological mothers and resident fathers **Data collection :** 9 months postpartum **Recruitment:** Children born in 2001, primary sampling units from the National Centre for Health Statistics vital statistics system	Centre for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977)	**Context:** Self-report questionnaire of 7 items indicating the frequency of engaging in interactions **Interaction dimensions coded:** 1. Enrichment activities 2. Play activities	Depressed fathers were less likely to engage in enrichment/play activities i.e. play outside the home and sing songs in comparison to non-depressed fathers	1.CES-D scores don't provide a clinical diagnosis 2.Measure of parenting behaviour limited to self-report 3. The range of response options is narrow and may provide a weak association between depression and interaction.

Appendices for chapter 2

Appendices 2A-2E

Appendix 2A: Researchers contacted

Researchers contacted to retrieve relevant publications
Hiram E. Fitzgerald*
Joyce Magill-Evans
Brenda L. Volling*
Jay Belsky
Ruth Feldman
Catherine S. Tamis-LeMonda
Natasha Cabrera
Karin Grossmann*
Thomas G Power*
Mechthild Papousek
Sherry H. Goodman
Ian H. Gotlib*
Mark Bornstein
Michael Lamb*
Tiffany Fields*
Janice H Goodman
Nathan Fox*
Ross Parke
Grazyna Kochanska
P.Trautmann-Villalba*
Manfred Laucht*

Note: * e-mail response received

Appendix 2B: Data extraction form

Paper ID: 1

Title of study: Mother-Child and Father-Child Mutually Responsive orientation in the first 2 years and Children's Outcomes at Preschool age: Mechanisms of Influence

Type/Year of Publication: Journal; Child Development (2008)

Research Design: Longitudinal

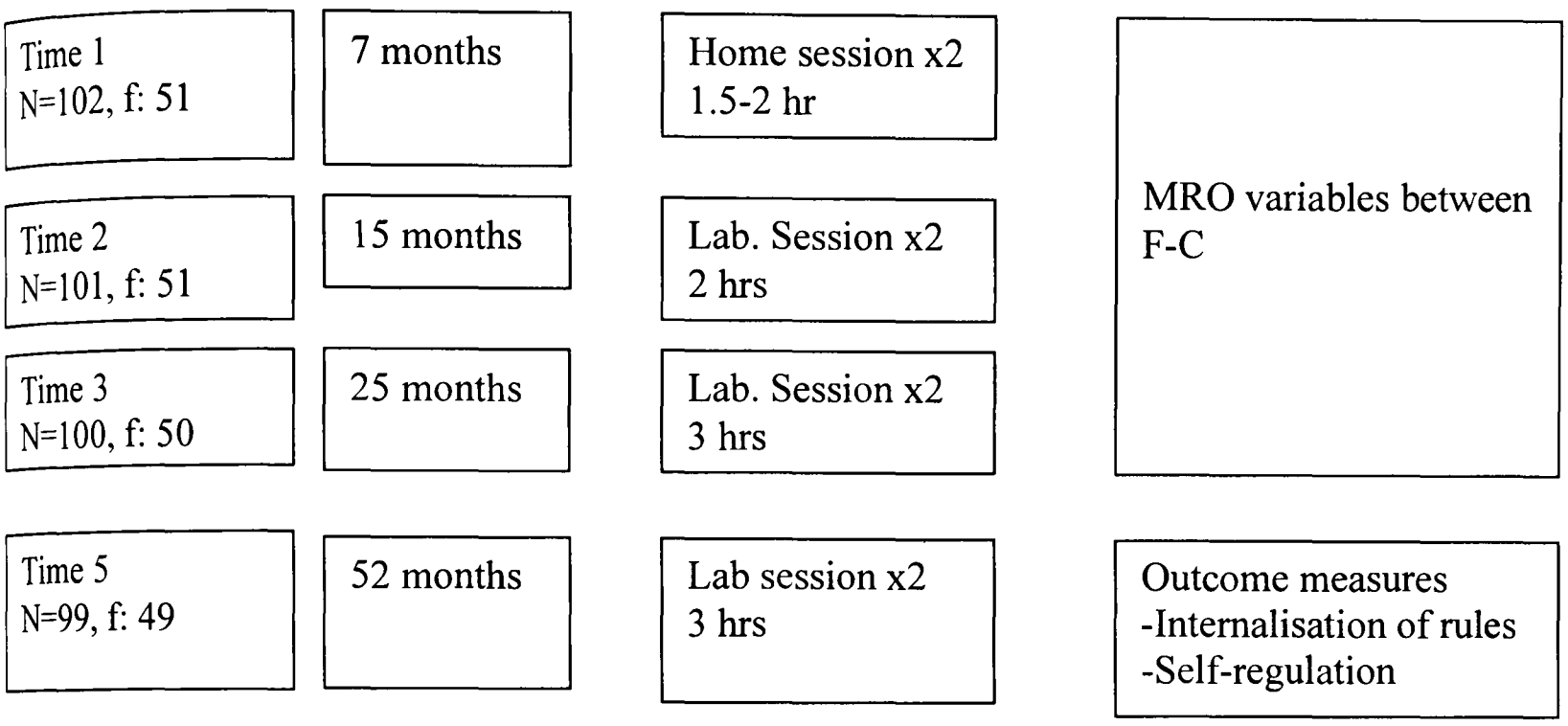
Method of recruitment

Adds in multiple community venues
Letters sent to families identified using birth records

Sample description

Size (Total)	102
Gender	Males: Females:
Birth order	First: 42% Second: 35%
Study population	Normal: Yes Clinical:
Recruitment	Community sample
Clinical status of father	Normal
Father's Education	High school Education: 30% Associate degree: 18% Completed college: 33% Post-college education: 20%
Father's Employment	Under 10,000$- 2% 10,000-20,000-6% 30,000-9% 30,001-40,000-8% 40,000-50,000-17% 50,000-60,000-9% 60,000-70,000-15% Over 70,0001-34%
Gestational Age	No information
Father's age yrs. (mean, SD):	32.23 (6.03)
Ethnicity (Father)	84% white, 8% Hispanic, 3% African American, 3% Asian 2% other

Study overview



Measures

Father-Infant Interaction (All observable measures of F-I)

Interaction construct	Mutually Responsive Orientation
Components of construct	Coordinated routines Mutual cooperation Harmonious communication Emotional ambience
Context	Home Based ✓ Lab Based ✓
Content of tasks (3 time points)	Play with toys, Snack Parent busy
Additional contexts	7 months Care-giving routines Play without toys Parent trying to keep the child from touching an attractive plant 25 months Free time in the lab Interactive chore Opening a gift
Length of each play session	40-47 min. per session

Child outcome/s

Number of outcomes in the study	Single: Multiple: ✓ [2]
Child outcome	Internalisation of parent's prohibition Effortful control
Number of repeated measures of the outcome & Time points for the outcome	Repeated measure: n/a Time points: [1]
Description of outcome:	Internalisation of parents prohibition Self regulation
Measure 1. Standardised Self-Report 2. Parent Report 3. Observable measure 4. Independent reporter	 Outcome 1: Observable measures Outcome 2: Observable measures
Description of tasks for the outcome 1. Internalisation of parents prohibition	Internalisation of parent's prohibition regarding the off-limit attractive objects 8 min- [Procedure described and referenced] 5 dimensions 1. looking at the toy without touching 2. engaged in other activity 3. sorting 4. touching toys gently 5. self correcting 6. deviating (playing with the toys)
2. Self-regulation	Effortful control tasks Measures of performances Capacity to suppress a dominant behaviour; perform sub-dominant behaviour Delaying tasks (5) Slowing down tasks (3) Suppressing or slowing down a response to one type of signal and producing or initiating another Whisper task Effortful attention

Methodological quality

Attrition

Coding and reliability analysis
The same coder did not code both maternal and paternal behaviours in a family
15-20% of sample used for reliability
Realignment check conducted for coded material to prevent observer drift

Results

Correlations

F-C MRO ⟶ Outcome
Internalization-With F
(r=0.17, p<0.10)
Internalization – With M
(r=0.17, p<0.10)
C-Self-regulation-
(r=0.28, p<0.01)

Maximum likelihood estimates

F-C MRO ⟶ Outcome
Internalization of paternal prohibition
(Total effect=0.17, SE =0.11, ns)
C-self regulation
(Total effect=0.15, SE=0.05, p<0.05)

Mediators
Gender
Father's power assertion
C's self-representation

Limitations
Parents predominantly white
Caution when generalising to ethnically diverse areas

Appendix 2C: Excluded publications

ID (Excluded)	Publication/Title	Reasons for exclusion*
Social functioning/Relation specific outcomes		
1.	*Jones et l., (1986)* Father-newborn interaction: Effects of social competence and infant state	Interaction as outcome
2.	*Youngblade and Belsky, (1992)* Parent-child antecedents of 5 year-old's close friendships: A longitudinal analysis	Timing of interaction measure
3.	*Kelly et al., (1998)* Importance of fathers parenting to African-American toddlers social and cognitive development	Cross-sectional study design
4.	*Main and Weston, (1981)* The Quality of the toddlers relationship to the mother and father: related to conflict behaviour and the readiness to establish new relationships	Cross-sectional study design
5.	*Volling & Belsky., (1992)* The contribution of mother-child, father-child relationships to the quality of sibling interaction: A longitudinal Study	Timing of interaction measure
6.	*Freitag et al., (1996)* Continuity in parent-child relationships from infancy to middle childhood and relations with friendship competence	Maternal data
7.	*Carson et al., (1996)* Reciprocal Negative Affect in Parent-Child Interactions and Children's Peer Competency	-Cross sectional study design -Timing of interaction measure at 4-5 years
8.	*Black et al., (1995)* Links between communication patterns in mother-child, father-child and child-peer interactions and children's social status	Cross sectional study design
9.	*MacDonald and Parke, 1984*	

	Bridging the Gap: Parent-Child Play Interaction and Peer Interactive Competence	-Cross sectional study design -Timing of interaction measure at 3-5 years
10.	*Landry et al., 2001* Does early responsive parenting have a special importance for children's development or is consistency across early childhood necessary?	Maternal data
11.	*Isley et al., (1999)* Parent and child expressed affect and children's social competence: Modelling direct and indirect pathways	Timing of interaction measure at 3-5 years
Cognitive development		
12.	*Gartstein et al. (2008)* Early makers of language and attention Mutual contributions and the impact of parent-infant interactions	Cross sectional study design
13.	*Shannon et al., (2002)* Beyond Rough and tumble: Low income fathers interactions and children's cognitive development at 24 months	Cross sectional study design
14.	*Poehlmann et al., (2001)* Parent-infant interaction as a mediator of the relation between neonatal risk status and 12 month cognitive development	Maternal data
15.	*Yogman et al., (1995)* Father involvement and cognitive/behavioural outcomes of pre-term infants	Behavioural observations not included
16.	*Feldman et al., (2002)* Comparison of skin to skin (Kangaroo) and Traditional care: Parenting outcomes and pre-term parenting care	Time between interaction measure and outcome measure not ≥ 12 months
17.	*Clarke-Stewart et al., 1978* And daddy makes three: The fathers impact on mother and young child	Triadic data analysed

18.	*Epstein et al., 1975* Motivational components related to father behaviour and cognitive functioning in preschoolers	Cross sectional study design
19.	*Roopnarine et al., 1985* Mother-child and father-child play	Timing of interaction measure at 46-60 months
20.	*Yarrow et al., 1984* Developmental course of parental stimulation and its relationship to mastery motivation during infancy	Time between interaction measure and outcome measure not ≥ 12 months
21.	*Moore et al., 1998* Parent-Child interaction and developmental outcomes in medically fragile, high risk children	Maternal data
22.	*Keller et al., 2005* Parenting styles and the development of the categorical self: A longitudinal study on mirror self-recognition in Cameroonian Nso and German families	Maternal data
Behavioural functioning		
23.	*Eisenberg N. et al., (2005)* Relations among positive parenting, children's effortful control and externalizing behaviour problems: A three wave longitudinal study	Maternal data Timing of interaction measure
24.	*DeKlyen et al., (1998)* Fathering and early onset conduct problems: positive and negative parenting, father-son attachment, and the marital context	Review paper
25.	*Gadeyne et al., 2004* Longitudinal relations between parenting and child adjustment in young children	Behavioural observations not included

Academic functioning		
26.	*Radin N. (1972)* Father-Infant interaction and the intellectual functioning of four year old boys	Cross sectional study design Timing of interaction measure
27.	*Feldman and Wentzel (1993)* Parental predictors of boys self-restraint and motivation to achieve at school: A longitudinal study	Cross sectional study design
28.	*Feldman and Wentzel (1990)* Relations among family interaction patterns, classroom self-restraint and academic achievement in preadolescent boys	Timing of interaction measure
29.	*Blanchard and Biller (1971)* Father's availability and academic performance among third grade boys	Behavioural observations not included
Attachment		
30.	*Chibucos et al., (1981)* Longitudinal examination of father-infant interaction and infant-father attachment	Time between interaction measure and outcome measure not ≥ 12 months
31.	*Braungart-Rieker at al., (2001)* Parental sensitivity, infant affect and affect regulation: Predictors of later attachment	Time between interaction measure and outcome measure not ≥ 12 months
Psycho-social adjustment		
32.	*Leinonen et al.,(2003)* Parental mental health and children's adjustment: the quality of marital interaction, and parenting ad mediating factors	Timing of interaction measure
33.	*Flouri et al., (2007)* Fathering and adolescent's psychological adjustment: the role of father's involvement, residence and biological status	Cross sectional study design

34.	*Eiden et al (2007)* A conceptual model for the development of externalizing behaviour problems among kindergarten children of alcoholic families: Role of parenting and children's self-regulation	Alcoholic fathers
35.	*Simons and Conger, (2007)* Linking mother-father differences in parenting to a typology of parenting styles and adolescent outcomes	Timing of interaction measure

Note: * **7** studies excluded due to the interaction measure collected after 24 months; **11** studies were cross-sectional in design; **6** studies reported maternal data only, **3** studies did not include behavioural measures of interaction, **4** studies did not fulfil criteria for the time period between exposure and outcome as ≥ 12 months, **3** studies were not included for other reasons; **1** study included paternal substance abuse (alcoholic fathers).

Appendix 2D: Summary of longitudinal studies that examined the influence of father-infant interaction on child outcome[1]

ID/Citation/ Country	Sample size	Observations of F-I interaction				Child outcome		
		Time points & context	**Age (months)**	**Length of time (min) & nature of observation**	**Predictor variable(s) and measure(s)**	**Age (months)**	**Outcome variable(s)**	**Coding schemes and measures of outcome**
Behavioural outcomes *(n=4)*								
4. Benzies et al., (1998) (Canada)	N=74 m:42 f:32 *Healthy pre-term and term infants*	1 session (Home based)	12 months	Teaching a standardised task	**Coding scheme** Nursing Child Assessment Teaching Scale(NCATS Sumner & Spietz, 1994) **Variables coded** *Parent behaviour* 1. Sensitivity to cues 2. Response to the child's distress 3. Social-emotional	42-54 months	**1. Behaviour problems**	1. Eyberg Child Behaviour Inventory (ECBI, Eyberg, 1992) Mother & father reports on problem behaviour in the child. Two scales are derived: Intensity score and a total problem score

[1] Total number of publications suitable for the review (N=16). Three papers *(Ryan et al., 2006, Park et al., 1997 and Cabrera et al., 2007)* have been excluded from this table as they are based on the same studies (Paper ID's 8 and 5 included in the table). Three papers (ID. numbers; 4, 7 and 12) use the same study but report on different outcomes or use different time points for their measurement; hence they have all been included in this table. The table consists of a summary of 13 papers from 10 studies.

					growth fostering 4. Cognitive growth fostering			
5. **Belsky et al. (1998)*** (USA)	N=125 m: 125 *First born male infants*	4 sessions (Home based)	1. 15 months 2. 21 months 3. 27 months 4. 33 months	Observation around dinner time 60 minutes	**Variables coded** *Parent behaviour* 1. Positive affect scale *(positive emotions)* 2. Negative affect scale *(negative emotions)* 3. Sensitivity scale *(awareness of the child's experience)* 4. Intrusiveness *(insertion of parental goals and agenda)* 5. Detachment *(uninvolved and unresponsive)* **Composite scores** 1. Positive parenting 2. Negative parenting 3. Grand composite *POS-NEG*	37 months	**1.Externalizing problems**	1. Child Behaviour Checklist (Achenbach et al., 1987) Maternal and paternal ratings averaged on the externalizing scale
14. **Feldman & Eidelman (2004)**	N= 138	1 session (Home	3 months	Free-play 5 minutes	**Play dimension** Synchrony *(Coordinated behaviour*	24 months	**1. Behaviour problems**	Child behaviour Checklist for Ages 2 to 3 Years (CBCL/2-3; Achenbach, 992)

(Israel)	Single infant (n= 23) Twins (n=23) Triplets (n=23)	based)			*in gaze, vocalisation and touch)* **Variables coded** *Parent behaviour* 1. Gaze 2. Affect 3. Vocalization 4. Touch 5. Proximity position *Infant behaviours* 1. Gaze 2. Affect 3. Vocalization Parent-infant synchrony 1. Gaze synchrony 2. Co-vocalization 3. Touch synchrony			Maternal completed measure used to generate three summary scores 1. A total behaviour score 2. An internalizing symptoms score 3. An externalizing symptoms score
3. Trautmann -Villalba et a.l., (2006) (Germany)	N= 72 m: 37 f: 35 *First born infants*	1 session (Lab. based)	3 months	Standardised nursing and play situation 5 minutes	**Play dimensions** Affect and sensitivity **Coding scheme** Adapted version of the Categorical System for Micro-Analysis of the Early Mother-Child Interaction (Jorg et al.	96 months (8 yrs) 132	**1. Externalizing behaviours**	1. Child Behaviour Checklist (CBCL, Achenbach, 1991) Maternal report on the Externalizing Problems Scale 1. Aggressive behaviour 2. Delinquent behaviour

					1994) **Variables coded** *Paternal behaviours* 1. Positive emotionality *(smiling, eye contact)* 2. Sensitive fathering *(loving, close proximity, vocalizations)* 3. Non-responsive fathering *(emotionally unresponsive)* *Interactive factors* 1. Father sensitive-infant negative 2. Positive reciprocity 3. Father non-responsive-infant active	months (11 yrs)		

ID/Study	Sample size	Observation of F-I interaction				Child outcome		
		Time points & context	**Age (months)**	**Length of time (min) and nature of the interaction**	**Predictor variables and measure(s)**	**Age (months)**	**Observation variable(s)**	**Coding scheme and measures of outcome**

Cognitive development *(n=5)*								
8. Tamis-LeMonda et al., (2004) (USA)	N= 290 m:142 f: 148 *Low-income families*	2 sessions (Home based)	1. 24 months 2. 36 months	Semi-structured free play 10 minutes	**Coding scheme** Scales adapted from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care's Three Box scales (Clarke-Stewart et al., 2002, NICHD Early Child Care Research Network, 1999) **Variables coded** *Positive dimensions* 1. Sensitivity 2. Positive regard 3. Cognitive stimulation *Negative dimensions* 1. Intrusiveness 2. Detachment 3. Negative regard	24 & 36 months 36 months	**1. Cognition** **2. Receptive Vocabulary**	1. The mental scale of the Bayley Scales of Infant Development (BSID-II; Bayley, 1993) *Mental Scale dimensions* Memory Problem solving Early number concepts Generalization skills Classification abilities Vocalizations Language Social skills 2. Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997)
7. Magill-Evans et al., (2001) (Canada)	N= 93 n=44 preterm infants	2 sessions (Home based)	3 & 12 months	Teaching Interaction 5-10 minutes	Nursing Child Assessment Teaching Scale(NCATS Sumner & Spietz, 1994)	48 months	**1. Motor and cognitive development**	1. McCarthy Scales of Children's Abilities (Mc Carthy, 1972) General Cognitive Index (CGI) 1. Verbal 2. Perceptual performance

	n=49 full-term infants *(groups matched on infant gender)*				**Variables coded** *Parent behaviour* 1. Sensitivity to cues 2. Response to the child's distress 3. Social-emotional growth fostering 4. Cognitive growth fostering		**2. Language development**	3. Quantitative Scales Motor Scales 1. Gross motor & fine motor skills 2. Clinical Evaluation Language Fundamentals- Preschool (CELF-P, Wiig et al., 1992) Dimensions of language 1. Linguistic concepts *[receptive language]* 2. Recalling sentence concepts *[expressive language]*
12 Magill-Evans et al., (1999) (Canada)	N=103 Full term n=54 Healthy Preterm n=49 m: 59 f: 44	2 sessions (Home based)	3 & 12 months	Teaching a standardised task	**Coding scheme** Nursing Child Assessment Teaching Scale(NCATS Sumner & Spietz, 1994) **Variables coded** *Parent behaviour* 1. Sensitivity to cues 2. Response to the child's distress 3. Social-emotional growth fostering	18 months	**1. Cognitive development** **2. Receptive language abilities** **3. Expressive**	1.The mental scale of the Bayley Scales of Infant Development (Bayley, 1969) 2.Sequenced Inventory of Communication Development-R (SICD-R, Hedrick et al., 1984) Parent-report and direct observation *Variables coded (awareness, discrimination, direct observation)* 3. Mac Arthur Communication

					4. Cognitive growth fostering		**language abilities**	Development Inventory (MCDI, Fenson et al., 1991) Parent report measure of the child's expressive language skills
9. **Hunter et al., (1987)** (USA)	N= 66 m: 35 f: 31 *First born infants*	2 sessions (Home based)	1. 6 months 2. 12 months	Observation of usual daily routine 60 minutes	**Play dimension** Synchrony *('Joint action variables)* **Coding scheme** Cited in Vietze et al., (1977) **Variables coded** Object directed and vocalisation behaviours of infants and parents **Joint action measures** 1. Parent vocalize-infant vocalize 2. Parent vocalize-infant object directed 3. Parent object stimulation-infant vocalize 4. Parent object stimulation-infant object directed	30 months	**1. Cognitive development**	1. Lab based assessment on the McCarthy Scales of Children's Abilities (MSCA; McCarthy, 1972) *Four scale scores* Verbal Quantitative Memory Perceptual performance *Composite score* General Cognitive Index
16. **Lindsey et**	N= 80	1 session	1. 18	Free play	**Play dimension**	36	**1. Language**	1. Lab. based assessment using the

al., (2009)* (USA)	m: 39 f: 41	(Lab. based)	months	with toys provided 15 minutes	Synchrony *(bidirectional dimensions of parent and child interactional style)* Emotion, Initiation and Response **Coding Schemes** Synchrony: (Mize & Pettit, 1997) Initiation and Response coding: Lindsey and Mize (2000) **Variables coded** 1. Father-child dyadic reciprocity 2. Shared positive emotion 3. Shared negative emotion 4. Dyadic initiation 5. Mutual compliance	months		Reynell developmental language scales (RDLS; Reynell, 1990) Verbal comprehension and expressive language skills

ID/Study	Sample size	Observations of F-I interaction				Child outcome		
		Time points & context	**Age (months)**	**Length of time (min) & nature of observation**	**Predictor variable(s) and measure(s)**	**Age (months)**	**Outcome variable(s)**	**Coding schemes and measures of outcome**

Other outcomes (Attachment representation (*n=1)*, self-regulation *(n=2)*, internalization of rules *(n=1)*, inhibited behaviours *(n=1)*, peer relations *(n= 1)*, false-belief understanding *(n=1)*, self-recognition (*n=1)*								
10. Grossmann et al., (2002) (Germany)	N=49 m:26 f: 23	2 sessions (Home based)	1. During the first yr. (2, 6, & 10 months) 2. 24 months	Direct observations Free play 10 minute	**Play dimension** -1st yr. Sensitivity: *(Sensitive responsiveness, synchrony, empathy, warmth)* **Coding Scheme** (Ainsworth et al., 1974) **Play dimension-** 24 months. Sensitivity: *(sensitivity, corporation, challenge)* **Coding scheme** Sensitive and Challenging Interactive Play Scale (SCIP, Kassubek, 1995) **Variable(s) coded** Sensitivity	72, 120 & 192 months (6, 10 & 16 yrs.)	**1. Attachment representation** **Definition** Security of attachment representation	Coding schemes and variables coded 1. Separation Anxiety Test (SAT, Klagsbrun & Bowlby, 1976) *At age 6 a projective technique to examine the child's thoughts, feelings and reported behaviours in response to pictures; interview administration* 2. Attachment and current relationship interview (ACRI, Scheuerer-Englisch, 1989) *At age 10 years Children's self-report on attachment behaviour strategies in emotionally distressing situations* 3. Adult Attachment Interview (AAI, George et al., 1985) *Interviews at 16 years were coded for the following attachment representations:*

					Corporation Acceptance			*1. Secure* *2. Dismissing* *3. Preoccupation*
1. Kochanska et al., (2008) (USA)	N= 102	3 sessions 1. (Home based) 2 & 3 (Lab based)	1. 7 months 2. 15 months 3. 25 months	Multiple naturalistic play contexts 40-47 minutes	**Play dimension** Mutually responsive orientation (MRO) **Coding scheme** Mutually Responsive Orientation (MRO, Aksan et al., 2006) **Variables coded** 1.Coordinated routine 2. Mutual corporation 3. Harmonious communication 4. Emotional ambience	52 months	**1. Internalization of parents rules** **2. Self-regulation**	1. Kochanska et al., (2001) Observation of internalization of maternal and paternal prohibition regarding off limit attractive toys *2 factors produced by principal component analysis (PCA) for maternal and paternal prohibition* Observation of effortful control tasks; the capacity to suppress a dominant behaviour and to perform a sub-dominant behaviour
16. Lindsey et al., (2009)* (USA)	N= 80 m: 39 f: 41	1 session (Lab. based)	1. 18 months	Free play with toys provided 15 minutes	**Play dimension** Synchrony *(bidirectional dimensions of parent and child interactional style)* Emotion, Initiation and	36 months	**1. Self-regulation**	Observations of children in a multi-episode lab based task *Behavioural indices of regulation* 1. Active engagement *(manipulation and playing with the*

					Response **Coding Schemes** Synchrony: (Mize & Pettit, 1997) Initiation and Response coding: Lindsey and Mize (2000) **Variables coded** 1. Father-child dyadic reciprocity 2. Shared positive emotion 3. Shared negative emotion 4. Dyadic initiation 5. Mutual compliance			*forbidden toys)* 2. Minimal engagement time *(simple, momentary touches of the object)*
5. Belsky et al. (1998)* (USA)	N=125 m: 125 *First born male infants*	4 sessions (Home based)	1. 15 months 2. 21 months 3. 27 months 4. 33 months	Observation around dinner time 60 minutes	**Variables coded** *Parent behaviour* 1. Positive affect scale *(positive emotions)* 2. Negative affect scale *(negative emotions)* 3. Sensitivity scale *(awareness of the child's experience)* 4. Intrusiveness *(insertion of parental*	37 months	**1. Inhibition**	1. Behavioural observation in the laboratory on a series of social events. Behaviour rated by independent coders on a five point rating scale from no wariness to a great deal of wariness. *Behavioural indices of inhibition* 1. Shy and fearful facial expressions 2. Body tension 3. Experimenter avoidance 4. Hesitancy of response

					goals and agenda) 5. Detachment *(uninvolved and unresponsive)* **Composite scores** 1. Positive parenting 2. Negative parenting 3. Grand composite *POS-NEG*			5. Close proximity to parent
11. McElwain et al., (2004) (USA)	N=30 m:14 f: 16	1 session (Lab. based)	12 months	1.Free play 15 minutes 2.Open ended-teaching task (Vondra et al., 1995)	**Play dimension** Sensitivity: *(baby-centered behaviour including, contingent vocalizations, stimulation and encouragement)* **Coding Scheme** (Fish et al., 1991, 1993) Global measure of paternal sensitivity derived (Free-play + teaching task)	48 months	**1. Socialization** *Definition* Quality of child-friend relationship	Coding scheme for dyadic child-friend interactions 1. (Howes et al., 1994, Park & Waters, 1989; Youngblade & Belsky, 1992) *Observation of child-friend play (free-play & a sharing task) in the lab. coded for individual behaviours and dyadic interaction* **Variables coded** Individual behaviours *(Control, physical aggression, manage and responsiveness)* Dyadic interaction *(Coordination, conflict, shared positive)* **Composite scores on friendship** Positive child-friend interaction

									Negative child-friend interaction Overall friendship quality
								2. False-belief understanding *Definition* 'An individual's belief or representation about the world may be in contrast to reality'	2. 'Sally-Ann' false belief task (Baron-Cohen et al., 1985)
2. **Borke et al., (2007)** (Germany)	N= 24 m: 12 f: 12	1 session (Home based)	3 months	Free play 10 minutes	**Coding scheme** Component model of parenting (Keller, 2007) **Variables coded** 1. Body contact 2. Body stimulation 3. Object stimulation 4. Face to face gaze	18-20 months	**1. Self-recognition**	1. Rouge test (Amsterdam, 1972; Bischof-Lohler, 1989) Recognition of self in a mirror

Note: *The paper is presented twice as it falls under two developmental domains; F-I= Father-Infant; m= male, f= female; lab= laboratory based assessment

Appendix 2E: Individual publication results on the association between sensitivity and behavioural development, cognitive-linguistic development and other outcome domains2

ID/ Reference	Outcome	Analytic strategy	Results	Findings
Behavioural development *(n=4)*				
4. Benzies et al., (1998)	Problem behaviours	Correlational analysis	Paternal sensitivity-----Intensity score r = -0.03 Paternal sensitivity----- Problem score r = .02	Father-child interactions as measured by the NCATS at 12 months did not predict behaviour problems at four years.
5. Belsky et al. (1998)	Externalizing problems	Regression analysis Cross-time grand composite fathering score (i.e. Pos-Neg. 15+21+27+33 months)	Fathering ----------externalizing problems β =-.08, *ns*	Early fathering (in the first two years) did not predict behaviour problems and 37 months.

[2] Data from a single paper were included in multiple (i.e. two) outcome domains in seven of the fourteen papers included in the review. These studies have been referenced twice in this table.

14. **Feldman & Eidelman (2004)**	Behaviour problems 1. Total behaviour problems 2. Internalizing 3. Externalizing	1. Correlations 2. Regression analysis predicting total behaviour problems, externalizing symptoms and internalizing symptoms from parent-infant synchrony *(average of mother-infant, father-infant gaze synchrony)*	Gaze synchrony---------lower internalizing r = -.28, p< .05 Covocalization-------lower internalizing r = -.28, p< .05 Covocalization--------lower externalizing r = -.30, p< .05 Total score: β = -.31, p < .05 Externalizing symptoms: β = -.27, p < .05 Internalizing symptoms: β = -.29, p < .05	Synchrony in father-child interactions at 3-months predicted the child's socio-emotional development at 24 months.
3. **Trautmann-Villalba et a.l., (2006)**	Externalizing behaviour groups 1. High externalizing 2. Low externalizing	ANCOVA	1. Effect of fathers behaviour on externalizing group Sensitive fathering $F_{(1,67)}$ = 8.24, p=.005 Non-responsive fathering $F_{(1,67)}$= 5.17, p=.026	Children of fathers who were less sensitive and less responsive during interactions at 3-months were more likely to develop externalizing problems at 11 years.

			Positive emotionality $F_{(1,67)} = .21$, p=.886 2. Patterns of father-infant interaction Sensitive fathering & negative infant $F_{(1,67)} = 5.23$, p=.025 Non-responsive fathering & active infant $F_{(1,67)} = 4.16$, p=.045 Positive reciprocity $F_{(1,67)} = .23$, p=.632 Means and *(SE)* for Low and High externalizing groups Low High Sensitivity .21*(.14)* -.49 *(.19)* Non-responsiveness -.22 *(.14)* .32 *(.19)* Positive emotionality .01 *(.15)* .03 *(.21)*	Children who developed externalizing problems by the age of 11 years were more likely to be exposed to less close, less loving, and less communicative fathers. They also experienced less emotional responsiveness from their fathers who engaged in more physicality when the infant was more vocally and bodily active at 3 months.
Study	**Outcome**	**Analytic strategy**	**Results**	**Findings**
Cognitive development *(n=4)*				
8. Tamis-LeMonda et al., (2004)	Cognition	1. Correlation between 24 month play and 36 months	Interaction dimensions MDI Sensitivity .30***	Positive aspects of father's engagement (i.e. sensitivity, cognitive stimulation and

		outcome measures 2. Regression analysis	Positive regard .22** Cognitive stimulation .30*** Detachment -.17* Intrusiveness -.18* Negative regard -.12 *** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$ 3 composite measures of parenting: 1. Supportive parenting *(Sensitivity, Positive regard, Cognitive stimulation)* 2. Overbearing parenting *(Negative regard, Intrusiveness)* 3. Detached parenting Paternal supportive parenting--------MDI $\beta = .25$, $p \leq .01$	positive regard) at 24 months predicted children's MDI and scores at 36 months. Even when children's earlier performance at 24 months was taken into account father's supportive parenting was associated with children's cognitive development.
7. Magill-Evans et al., (2001)	Cognitive development General Cognitive Index: Summing verbal, perceptual performance and quantitative scales	1. Correlation between predictor variables (interaction at 3 and 12 months) and child's cognitive development 2. Forward step-wise linear regression 3. Variables	Paternal behaviours Outcome 3months 12months General Cognitive Index *(GCI)* .02 .06 Paternal behaviour was not a significant predictor in the preliminary regression analysis	Paternal sensitivity in the first year was not associated with the child's cognitive functioning at 48 months.

		significant in the step-wise linear regression entered order-wise in a hierarchical regression		
12 **Magill-Evans et al., (1999)**	Cognitive development	Linear regression applied in two stages: Step 1. Identification of paternal interaction as a significant predictors of child's mental development Step 2. Identification of significant predictors across categories of paternal, maternal and child variables	Step 1. Fathers interaction at 12 months was associated with the child's Bayley mental score Step 2. Entered into the regression equation the father's interaction (NCATS parent score) did not predict cognitive development	Paternal interactive behaviours in the first year were not associated with the child's cognitive functioning at 18 months.

9. **Hunter et al., (1987)**	Cognitive development	1. Correlations between 6 and 12 month interaction measures and child outcome at 30 months	1. 6 month to 30 month correlation *[not reported]* 2. 12 to 30 month correlations *(r)* McCarthy Scale scores 12 month — GCI **P-I joint actions** Father-object infant-vocalize .11 Father-object infant-object .12 Father-vocalise infant-vocalize .00 Father-vocalize-infant object .26 Scale scores 12 month — Verbal — Quantitative **P-I joint actions** Father-object/ infant-vocalize .14 .12 Father-object/ infant-object .23 .19 Father-vocalise/ infant-vocalize -.07 .03 Father-vocalize/ infant object .25 **.32***	Paternal synchronous behaviours at both 6 and 12 months were not associated with cognitive outcomes at 30 months.

			Scale scores 12 month — Memory — Perceptual **P-I joint actions** Father-object/ infant-vocalize — .14 — .04 Father-object/ infant-object — .15 — -.13 Father-vocalise/ infant object — .01 — .17 Father-vocalize/ infant-vocalize — .22 — .01	
Language development *(n=4)*				
12 **Magill-Evans et al., (1999)**	1. Receptive language 2. Expressive language	Linear regression applied in two stages: Step 1. Identification of paternal behaviours as a significant predictor of child's language	1. Receptive language Step 1. Fathers interaction at 3 months (NCATS parent score) was a significant predictor of the child's receptive language Step 2. Father-infant interaction remained a predictor in the second stage of the analysis	Paternal interactions at 3 months predicted the child's receptive language at 18 months.

<table>
<tr>
<td></td>
<td></td>
<td>development
Step 2.
Identification of predictors across categories of paternal, maternal and child variables</td>
<td>Paternal sensitivity----Receptive language
$\beta = .19, p<.05$

2. Expressive language</td>
<td>Paternal interactions did not predict words produced (expressive skills) by the child at18 months.</td>
</tr>
<tr>
<td>7.
Magill-Evans et al., (2001)</td>
<td>1. Expressive language

2. Receptive language</td>
<td>1. Correlation between predictor variables (interaction at 3 and 12 months) and outcomes
2. Forward step-wise linear regression
3. Variables significant in the step-wise linear regression entered order-wise in a hierarchical regression</td>
<td><table><tr><th></th><th>Paternal behaviours
3months</th><th>12months</th></tr><tr><td>Expressive lang.</td><td>.01</td><td>.22</td></tr><tr><td>Receptive lang.</td><td>.06</td><td>.00</td></tr></table></td>
<td>More sensitive father-child interactions at 12 months were associated with higher child scores expressive language at 48 months.

Paternal behaviours were not associated with the receptive language sub-scale.</td>
</tr>
<tr>
<td>8.
Tamis-LeMonda et al., (2004)</td>
<td>Receptive vocabulary</td>
<td>1. Correlation between 24 month play and 36 months</td>
<td><table><tr><th>Interaction dimension</th><th>PPVT</th></tr><tr><td>Sensitivity</td><td>.26***</td></tr></table></td>
<td>Positive aspects of father's engagement (i.e. sensitivity, cognitive stimulation and</td>
</tr>
</table>

		outcome measures	Positive regard .25*** Cognitive stimulation .25*** Detachment -.08 Intrusiveness -.08 Negative regard .12 *** $p \leq .001$	positive regard) at 24 months predicted children's receptive language skills at 36 months.
16. Lindsey et al., (2009)	'Communicative competence' 1. Verbal comprehension (receptive language) 2. Expressive language	1. Bivariate correlations	Interaction correlations with language Receptive / Expressive Dyadic reciprocity .16 / .31** Shared positive emotion .19 / .25** Shared negative emotion .07 / -.08 Mutual initiation .10 / -.06 Mutual compliance .33** / -.16 ** $p<.01$	Father- child dyadic reciprocity and mutual compliance at 18 months made an independent contribution to the child's verbal comprehension at 36 months Father –child dyadic reciprocity and shared positive affect at 18 months made an independent contribution to the child's expressive language development at 36 months.
		2. Regression analysis	Dyadic reciprocity---------Verbal comprehension β= .25, $p< .05$ Mutual compliance-------Verbal comprehension β=. 36, $p<.01$ Dyadic reciprocity--------Expressive vocabulary β= .21, $p<.05$ Shared positive emotion-------Expressive vocabulary β= .34, $p< .05$	

Study	Outcome	Analytic strategy	Results	Findings
Other outcomes (Attachment representation (*n=1)*, self-regulation (*n=2)*, relation-specific outcomes (*n=4)*, self-recognition (*n=1)*				
10. Grossmann et al., (2002)	Attachment representation	1. Correlations between quality of paternal play sensitivity at 24 months and child security of attachment representation at ages, 6, 10 and 16 years 2. Hierarchical regression analysis predicting child attachment representations at 6, 10, and 16 years	The relationship between play sensitivity (24 months) and child attachment security Age 10 years: r(43)=.31, $p<.05$ Age 16 years (dimension 'security'): r(44)= .37, $p<.05$ Age 16 years (dimension 'dismissing'): r(44)= -.40, $p<.01$ 1. SAT security age 6 years β =.00, *ns* 2. ACRI security at 10 years β = .35, $p<.05$ 3. AAI security at 16 years i. Security dimension: β = .39, $p<.05$ ii. Dismissing dimension: β = -.42, $p<.01$ iii. Preoccupation: Not predicted by earlier play	At age 6 years paternal play did not predict child security. At age 10 years fathers who were 'more sensitive and gently challenging during play' at 24 months had securely attached children. At age 16 years adolescents with fathers who were more 'sensitive, responsive, corporative and appropriately challenging during play' at 24 months were securely attached on the secure and dismissing dimensions of the AAI.

1. **Kochanska et al., (2008)**	Internalization of parental rules	1. Correlation 2. Maximum likelihood estimates	Father (MRO) ---------- Internalization M- rated: r=0.17, p<.10 F- rated: r=0.17, p<.10 Total effect=.17, SE=0.11, *ns*	The total effect of early F-C Mutually Responsive Orientation (MRO) on child's internalization of paternal prohibition at 52 months was not significant.
11. **McElwain et al., (2004)**	Socialization Quality of the child-friend relationship	1. Bivariate associations 2. Hierarchical multiple regression	Paternal sensitivity------child-friend interaction dimensions 1. Positive child-friend interaction: r=.30 2. Negative child-friend interaction: r = .08 3. Overall friendship quality r= .17 2. Paternal sensitivity at 12 months and friendship quality at 4 years Positive child-friend interaction β =.27, *ns* Negative child-friend interaction β =.09, *ns* Overall friendship quality β =.14, *ns*	Paternal sensitivity at 12 months does not make a unique contribution to the quality of child friendship at 48 months.
11. **McElwain et al.,**	False-belief	1. Bivariate	False-belief understanding	Paternal sensitivity at age 12

<table>
<tr><td>(2004)</td><td>understanding</td><td>associations

2. Repeated – measures ANOVA</td><td>r= .34, p<.10

Means (SEs) of paternal sensitivity for high and low false-belief groups at age 4

<table><tr><td></td><td colspan="2">False belief groups</td></tr><tr><td></td><td>Low</td><td>High</td></tr><tr><td>Sensitivity</td><td>1.15 (.06)</td><td>1.29 (.05)</td></tr></table></td><td>months was associated with children's understanding of false-belief at 48 months.</td></tr>
<tr><td>1.
Kochanska et al., (2008)</td><td>Self-regulation
Effortful control</td><td>1. Correlation

2. Maximum likelihood estimates</td><td>Father (MRO)----------Self-regulation
r=.28, p<0.01

Total effect=.15, SE=0.05, p<.05</td><td>Father-child MRO had an impact on the child's self-regulated behaviours at 52 months.</td></tr>
<tr><td>16.
Lindsey et al., (2009)</td><td>Self-regulation
1. Active engagement time
2. Minimal engagement time</td><td>1. Bivariate correlations

2. Regression analysis</td><td>Correlations between interaction and self-regulation

<table><tr><td></td><td>Active</td><td>Minimal</td></tr><tr><td>Dyadic reciprocity</td><td>-.28**</td><td>-.16</td></tr><tr><td>Shared positive emotion</td><td>-.21*</td><td>-.13</td></tr><tr><td>Shared negative emotion</td><td>.02</td><td>.11</td></tr><tr><td>Mutual initiation</td><td>.04</td><td>.02</td></tr><tr><td>Mutual compliance</td><td>-.31**</td><td>-.22*</td></tr></table></td><td>Dyadic reciprocity, emotional engagement and mutual compliance at 18 months made an independent contribution to the child's self-regulation at 36 months</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>* p< .05, ** p<.01

Dyadic reciprocity---------Active engagement β=-.27*, p< .05
Shared positive emotion------Active engagement β= -.30*, p< .05
Mutual compliance-------Active engagement β=-.25*, p<.05
Dyadic reciprocity--------Minimal engagement β= -.31*, p<.05
Mutual compliance------- Minimal engagement β= -.32*, p< .05</td><td></td></tr>
<tr><td>5.
Belsky et al. (1998)</td><td>Inhibition</td><td>1. Regression analysis
Cross-time grand composite fathering score (i.e. Pos-Neg. 15+21+27+33 months)
2. Regression analysis to specify the timing and nature of father-child interaction on inhibition among children high in emotional</td><td>Fathering ----------inhibition
β =.31, p<.01

Fathering predicting inhibition in the second year
<table><tr><th>Fathering</th><th>R</th><th>ΔR^2</th><th>FΔ</th><th>b</th></tr><tr><td>Negative</td><td>.11</td><td>.11</td><td>7.47</td><td>-.13</td></tr><tr><td>Positive</td><td>.18</td><td>.07</td><td>5.19</td><td>.18</td></tr></table></td><td>Less negative fathering in the second year and more positive fathering was associated with more inhibited child behaviour</td></tr>
</table>

		negativity. The father composite (Pos-Neg. 15+21+27+33) was decomposed to positive and negative fathering in the 2nd year and third year. (Results for the second year are presented)		
2. Borke et al., (2007)	Self-recognition	2-level between subjects MANOVA	M *SD* 1.Body contact Self- recognition .48 *(.27)* Non-recognition .78 *(.23)* F (1,22) = 7.83, $p < .05$ M *SD* 2.Body stimulation Self- recognition .60 *(.14)* Non-recognition .60 *(.17)* F (1,22) = .00, *ns* M *SD* 3.Object stimulation Self- recognition .44 *(.27)* Non-recognition .23 *(.29)*	Children of fathers with a more distal parenting style (i.e. less body contact) at 3 months were more likely to recognize themselves in the mirror at 20 months.

			F (1,22) = 3.27, *ns* M *SD* 4.Face-to-face contact Self- recognition .60 .27 Non-recognition .64 .18 F (1,22) = 0.1, *ns*	

Note: NCATS= Nursing Child Assessment Teaching Scale, Pos-Neg= Positive-Negative, *(SE)* = Standard Error, MDI = Mental Development Index, GCI = General Cognitive Index, P-I= Parent-Infant, PPVT = Pea-body Picture Vocabulary Test, SAT = Separation Anxiety Test, ACRI= Attachment and Current Relationship Interview, AAI= Adult Attachment Interview, MRO = Mutually Responsive Orientation, M *(SD)* = Mean *(Standard Deviation).*

Appendix 2F: Other outcomes

Other outcomes examined are: attachment representation (Grossman et al., 2002), self-regulation (Kochanska et al., 2008; Lindsey et al., 2009), inhibited behaviour (Belsky et al., 1998), false-belief understanding (McElwain et al., 2004), relationship with peers (McElwain et al., 2004), internalization of parental rules (Kochanska et al., 2008) and self-recognition (Borke et al., 2007).

Grossman et al., (2002) examined paternal sensitivity at 24 months and security of attachment at 6, 10 and 16 years in a low-risk sample of 49 infants. Results of bivariate correlations indicate that sensitivity in early father-infant play was associated with the child's attachment security at age 10 years ($r = .31$, $p<.05$) measured with the Attachment and Current Relationship Interview (ACRI, Scheuerer-Englisch, 1989), and on the security dimension ($r = .37$, $p< .05$) and dismissing dimension ($r = -.40$, $p<.01$) of the Adult Attachment Interview (AAI, George et al., 1985) at 16 years. Sensitivity in play at 24 months was not associated with the 6 year olds attachment security measured using the Separation Anxiety Test (SAT, Klagsbrun and Bowlby, 1976). Hierarchical regression analyses used to predict child attachment representation at ages 6, 10 and 16 years indicated: paternal sensitive play did not predict child security at 6 years ($\beta = .00$, *ns*), it did predict ACRI security at 10 years ($\beta = .35$, $p < .05$), and the secure ($\beta = .39$, $p < .05$) and dismissing dimensions ($\beta = -.42$, $p < .01$) of the AAI at 16 years.

Kochanska et al., (2008) examined whether early Mutually Responsive Orientation (MRO) predicted self-regulation and internalization of parental rules in a sample of 102 father-infant dyads. MRO synonymous with the construct of synchrony (tapping into matched behaviours and positive states) influenced the development of self-

regulatory behaviours at 52 month (r = .28, p<.01) but was not associated with the child's internalization of paternal prohibition (r = .17, p< .10).

Lindsey et al., (2009) examined the association between dimensions of synchrony measured at 18 months and 36 month observational measures of self-regulation. Dyadic reciprocity (r = -.28, p< .01), emotional engagement (r = -.21, p<.05) and mutual compliance (r = -.31, p<.01) at 18 months were associated with the child's self-regulation at 36 months.

McElwain et al., (2004) studied two relationship specific outcomes at 48 months i.e. peer relationships and false- belief understanding in a sample of 30 infants in relation to paternal sensitivity at 12 months. Sensitivity did not predict peer relations (r = .17, *ns*), however children with high scores on the 'Sally-Ann' false-belief task had experienced increased paternal sensitivity in infancy (M= 1.29, *SE*= .05) compared to low scorers (M= 1.15, *SE*= .06); p< .10.

Belsky et al (1998)[3], investigated the influence of fathering on the development of inhibited behaviour *(shy, fearful, avoidant and hesitant)* at 37 months in a sample of 125 first born male infants. Using a regression model their findings suggest that fathering made a significant contribution to the prediction of inhibition (β = .31, p < .01), specifically more positive and less negative parenting across the first two years was associated with increased inhibition.

Borke et al., (2007) researched the influence of specific paternal interactive styles (proximity, stimulation, and face-to face contact) at 3 months in relation to self-recognition in children aged 18-20 months. Their results suggest that parents with a more distal parenting style (*M*= .48, *SD*= .27) were more likely to recognize

[3] The study reports multiple outcomes.

themselves in a mirror compared to children who experienced more body contact (M= .78, *SD*= .23); F (1, 22) = 7.83, $p < .05$.

Summary

In summary the above findings suggest that sensitive and challenging play measured by Grossman et al., (2002) influenced the development of attachment representation in 10 and 16 year old children, Mutually responsive orientation (MRO) measured by Kochanska et al., (2008) influenced the child's self-regulatory behaviours at 52 months, whereas dyadic reciprocity, emotional engagement and mutual compliance measured by Lindsey et al., (2009) made an independent contribution to the child's self-regulation at 36 months and paternal sensitivity measured by Mc.Elwain et al., (2004) influenced the child's understanding of false-belief at 48 months.

Appendices for chapter 3

Appendices 3A-3R

Appendix 3A: Video descriptions of paternal and maternal interactions

Father with infant at 3 months: The father seated before the infant smiles anxiously and asks, 'what are you doing chief'? The infant squirms and watches the father. 14 seconds later she vocalises and punctuates this with an abrupt movement of her leg and averts gaze. The father gently touches her forehead, imitates and amplifies his infant's vocalisation and facial expression. The infant makes eye contact.

An episode of mutual play follows. The father moves the infant's arms from side to side, simultaneously vocalising and reciprocating infant smiles, followed by a sudden high pitched sound and touch on the nose. This episode of energized interaction is followed by a period of calm; quieter sounds, and gentle touch.

In the second minute the episodes of play increase as the father sings to the infant accompanied by rousing arm movements and tapping of feet. These rhythmic arm movements and tapping episodes are accompanied by an increase in paternal pitch, synchronous smiles and infant laughter, followed by gentle touching of cheeks and fingers. In the last third 30 seconds of the session the father and infant engage in another short burst of excited play once again followed by gentle movement of limbs and touch around the forehead.

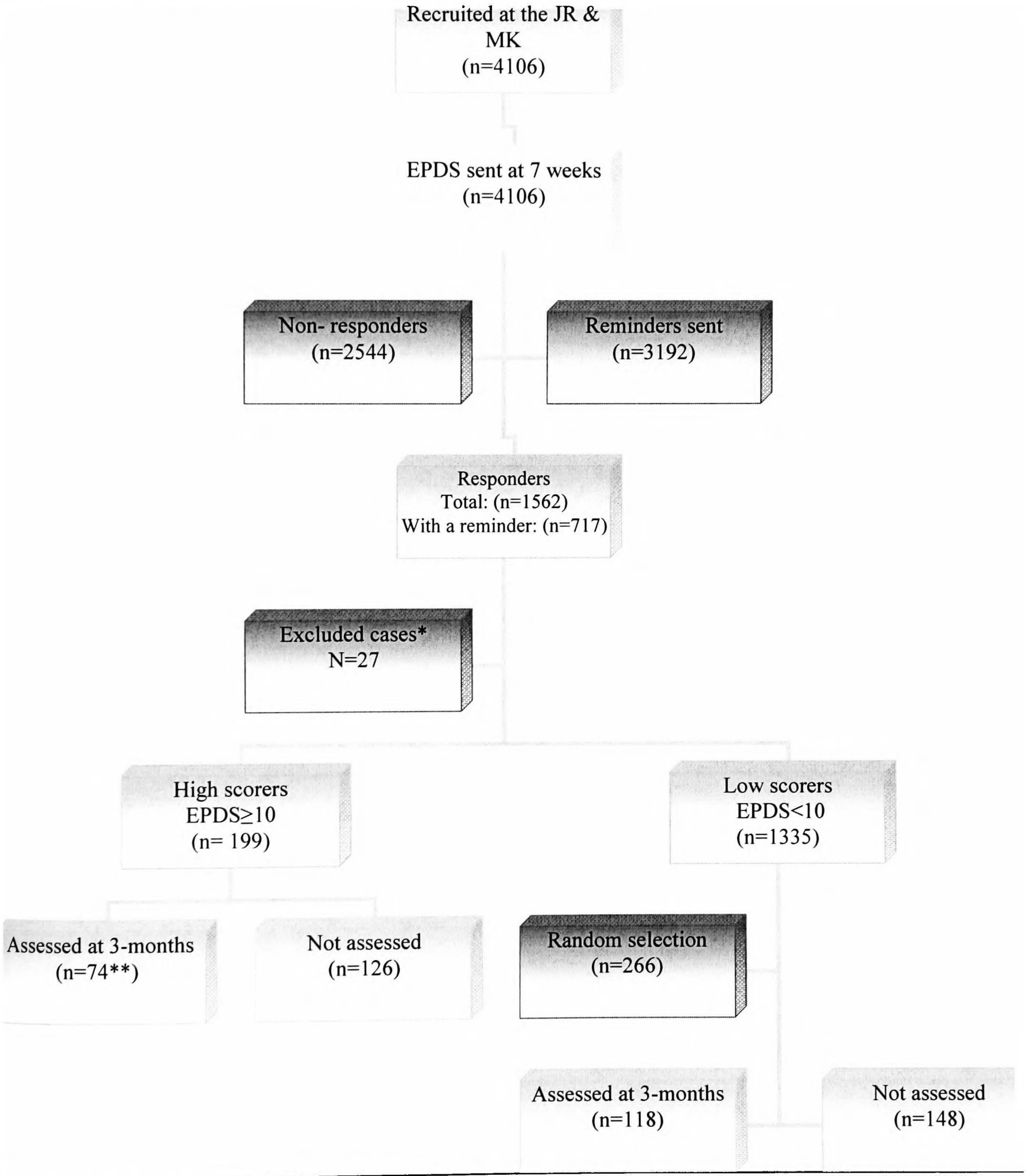
The above short bursts of arousal highlight the *'physical'* aspects of paternal play accompanied by sudden shifts in activity. The session alternating between high peaks of arousal and lower troughs of calmer engagement.

Mother with infant at 3 months: The mother seated before her infant, plays with her toes and kisses them gently before vocalising in a high pitched voice. The watching infant responds with a brief smile greeting after a latency of 7 seconds. Over the next 25 seconds of 'mutual orientation' the mother continues to vocalise, talk about the infant's current experience or praise the infant and smile at her. The infant watches and appears ready to interact.

They engage in an exchange of reciprocal vocalisations, smiles and positive affect lasting about 20 sec. The mother uses animated sounds, gently tickling and kissing her infant's toes. She praises the infant. The infant maintains eye contact, smiles and vocalises. This is followed by a pause in reciprocal play.

During these pauses the mother comments on a change in her infant's gaze, motor movements and affect. She smiles and talks to the infant re-engaging her in joint play. Two more interactive episodes are reinitiated over the course of the three minute session, alternating with a pause in communication. These alternating interactive episodes constitute the *'verbal games'* that mothers and infants engage in. They are characteristic of the smoothly modulated contained temporal shifts in mother-infant interaction.

Appendix 3B: Participant flow through the study stages



Note: JR= John Radcliffe, MK = Milton Keynes, * participants excluded due to missing items on the EPDS, ** EPDS for one participant was not completed at 7-weeks. The sample for the current study (N=118) includes currently depressed (n=19) and non-depressed (n= 99) fathers based on a clinical interview using the SCID.

Label	

Appendix 3C: Recruitment form

OXFORD FATHERS PROJECT

Fathers and their children in the postnatal period
Principal Investigator: Dr Paul Ramchandani

Contact Details

Mother

Title Mrs / Ms / Miss / Dr / Other

Name .....

DOB .....

Home Tel No .....

Mobile Tel No .....

Father

Title Mr / Dr / Other

Name .....

DOB .....

Work Tel No .....

Mobile Tel No .....

Home Tel No .....

Address (include postcode) .....

.....

.....

.....

.....

Father's Email Address .....

Child's Details

Child's Name .....
FORENAME SURNAME

Child's DOB ..... Boy / Girl (please circle)

Is this your first child? Yes ☐ No ☐ If not, this is our (e.g. 2nd) ..... child

Please sign overleaf to indicate your agreement to us having this information
We will not pass your contact information to anybody else

OXFORD FATHERS PROJECT

Have you read the information sheet?

Have you had the opportunity to ask questions and discuss the study?

Have you received satisfactory answers to all of your questions?

I agree to a member of the research team contacting me when my baby is approximately two months old.

Mother's Signature	**Date**	**Father's Signature**	**Date**
.....		.....	
Researcher's Signature	**Date**	**Researcher's Signature**	**Date**
.....		.....	

Appendix 3D: Infant and paternal demographic characteristics

Sample characteristic	Currently depressed (n=19)	Non-depressed (n=99)	Total sample (n=118)
Father's age (years)	36.68 (5.52)	34.47 (6.13)	34.83 (6.07)
Father's education level			
No qualification (%)	-	3 (3.0)	3 (2.5)
GCSE's (%)	1 (5.3)	13 (13.1)	14 (11.9)
School degrees (%)	4 (21.1)	9 (9.1)	13 (11.0)
Diploma (%)	5 (26.3)	15 (15.2)	20 (16.9)
Degree (%)	5 (26.3)	24 (24.2)	29 (24.6)
Postgraduate (%)	4 (21.1)	35 (35.3)	39 (33.1)
Marital status			
Single (%)	-	1 (1.0)	1 (.8)
Married (%)	16 (84.2)	77 (77.8)	93 (78.8)
Living together (%)	3 (15.8)	21 (21.2)	24 (20.3)
Ethnicity			
White (%)	18 (94.7)	91 (92.0)	109 (92.3)
Mixed Race (%)	-	2 (2.0)	2 (1.7)
Black African (%)	1 (5.3)	3 (3.0)	4 (3.4)
Black Caribbean	-	1 (1.0)	1 (.8)
Indian	-	1 (1.0)	1(.8)
Other (%)	-	1 (1.0)	1 (.8)
Infant Gender			
Female (%)	12 (63.2)	54 (54.5)	66 (55.9)
Male (%)	7 (36.8)	45 (45.5)	52 (44.1)
Infant birth order			
1st Child	7 (36.8)	64 (64.6)	71 (60.2)
2nd Child	8 (42.1)	26 (26.3)	34 (28.8)
3rd Child	2 (10.5)	8 (8.1)	10 (8.5)
4th Child	2 (10.50	1 (1.0)	3 (2.5)
Birth weight (kg.)	3.28 (.67)	3.45 (.62)	3.42 (.63)
Gestational age (weeks)	38.67 (2.25)	39.50 (1.78)	39.37 (1.88)

Note: Data are expressed as frequencies with percentages, or means with standard deviations in parenthesis.

Appendix 3E: Guide to set-up and videotaping interactions

Equipment

- Mirror
- Camera and tripod
- Infant car-seat
- Infant floor mat
- Stop watch
- Hair accessory to clip mother's hair back for recording free play

Set-up for the car seat interaction



Father-infant face to face interaction in the car seat context

- Well lit room. Lighting on the same side of the camera is ideal, strong lights from above tend to produce shadows
- The parent seated before the infant should be at, or slightly above the infants eye-level
- The mirror is positioned next to the baby which enables the camera to be seen near the centre if seated on the parent's chair
- The camera is placed on the tripod and the interaction is filmed from behind the parent's shoulder. The frame includes the infant's face and whole body, a full face reflection of the parent as well as a profile presentation.
- We avoid having both parents, siblings or pets in the room during the play interaction. Electronic equipment is switched off.
- The mirror is positioned to capture the parents facial expressions even when the parent moves forward or rocks the car seat

Instructions for interactions in the car seat context

'We are learning more about how parents play with their babies. We will video-tape your baby as he/she plays with you when placed in this seat. The mirror enables us to see what your baby is reacting to; otherwise his actions and facial expressions might seem random. Let us place your baby in the car seat. You may talk to and play with [infant's name] in any way you choose, perhaps how you would normally do without the use of any toys or objects. You may touch [infant's name] but try not to pick him/her up unless you feel it is really required. The play session lasts for three minutes and once we are ready, I will tell you when to start and stop'.

Set-up for the floor mat interaction



Father-infant face to face interaction in the floor mat context

- The floor mat is unfolded in an open space and the infant placed on it in a supine position
- The parent is positioned on his/her knees face to face with the infant
- The camera is placed on the tripod and the interaction is filmed from the side. The frame includes the infants face/side profile and whole body, and a profile presentation of the parent
- We avoid having both parents, other siblings or pets in the room during the play interaction. Electronic equipment is switched off.

Instructions for interactions in the floor mat context

'We would now like you to place your baby on the floor mat. Place [infant's name] on her/his back. Position yourself before your baby (demonstrated by the researcher). You may talk to and play with your baby as you would normally do

without using any toys or objects. This play session will also last three minutes and when ready I'll tell you when to start and stop'.

Additional notes

In both the free-play situations above, filming is stopped if the infant becomes inconsolably distressed and coded accordingly. We continue filming if mild distress is experienced to determine how the parent copes with the situation. If the infant placed in either context remains distressed for the first 10-15 seconds, videotaping is terminated and restarted either on the same day or rescheduled after discussion with the parents. The researcher also ensures that the interaction includes 3-minutes of uninterrupted play where possible.

Appendix 3F: EPDS screener

The way you are feeling in yourself is very important in understanding your experience of having a young child. These questions are about how you have been feeling in the past 7 days, not just how you feel today. Each statement about the way you feel has four different choices. Please tick the circle next to the answer that comes closest to the way you have been feeling over the past week.

1	**I have been able to laugh and see the funny side of things...**	O O O O	As much as I always could Not quite as much now Definitely not so much now Not at all
2	**I have looked forward with enjoyment to things...**	O O O O	As much as I ever did Rather less than I used to Definitely less than I used to Hardly at all
3	**I have blamed myself unnecessarily when things went wrong...**	O O O O	Yes, most of the time Yes, some of the time Not very often No, never
4	**I have been anxious or worried for no good reason...**	O O O O	Not, not at all Hardly ever Yes, sometimes Yes, very often
5	**I have felt scared or panicky for no very good reason...**	O O O O	Yes, quite a lot Yes, sometimes No, not much No, not at all
6	**Things have been getting on top of me...**	O O O O	Yes, most of the time I haven't been able to cope at all Yes, sometimes I haven't been coping as well as usual No, most of the time I have coped quite well No, I have been coping as well as ever
7	**I have been so unhappy that I have had difficulty sleeping...**	O O O O	Yes, most of the time Yes, sometimes Not very often No, not at all
8	**I have felt sad or miserable...**	O O O O	Yes, most of the time Yes, quite often Not very often No, not at all
9	**I have been so unhappy that I have been crying...**	O O O O	Yes, most of the time Yes, quite often Only occasionally No, never
10	**The thought of harming myself has occurred to me...**	O O O O	Yes, quite often Sometimes Hardly ever Never

Thank you for taking the time to answer our questions. Your answers are very valuable to our study. Please use our enclosed pre-paid envelope to post your questionnaire back to us.

Appendix 3G: Paternal demographics information



Interviewer: _____

F				

Date: _____

Your family details

1 What is your first language? .....

2 What is the main language you use with your baby? .....

3 Your ethnicity .....

4 Your highest qualification: .....

5 Employment status

Full-time ☐ Part-time ☐ On maternity leave ☐ Student ☐ No job ☐

6 Are you currently: Self employed ☐ Employed ☐

7 Your current or last job ..... If not current: date of last job .....

8 Are you going back to work?

Yes ☐ No ☐ If yes, when would you return? .....



Appendix 3H: The GRS subscales

GLOBAL RATING SCALES

FATHER						
Warm/Positive	5	4	3	2	1	**Cold/Hostile**
Accepting	5	4	3	2	1	**Rejecting**
Responsive	5	4	3	2	1	**Unresponsive**
Non-demanding	5	4	3	2	1	**Demanding**
Sensitive	5	4	3	2	1	**Insensitive**
Non-intrusive behaviour	5	4	3	2	1	**Intrusive behaviour**
Non-intrusive speech	5	4	3	2	1	**Intrusive speech**
Non-remote	5	4	3	2	1	**Remote**
Non-silent	5	4	3	2	1	**Silent**
Happy	5	4	3	2	1	**Sad**
Much energy	5	4	3	2	1	**Low energy**
Absorbed in infant	5	4	3	2	1	**Self-absorbed**
Relaxed	5	4	3	2	1	**Tense**

INFANT						
Attentive to mother	5	4	3	2	1	**Avoidant**
Active communication	5	4	3	2	1	**No active communication**
Positive vocalisations	5	4	3	2	1	**No positive vocalisations**
Engaged with environment	5	4	3	2	1	**Self absorbed**
Lively	5	4	3	2	1	**Inert**
Happy	5	4	3	2	1	**Distressed**
Non-fretful	5	4	3	2	1	**Fretful**

INTERACTION						
Smooth/Easy	5	4	3	2	1	**Difficult**
Fun	5	4	3	2	1	**Serious**
Mutually satisfying	5	4	3	2	1	**Unsatisfying**
Much engagement	5	4	3	2	1	**No engagement**
Excited engagement	5	4	3	2	1	**Quiet engagement**

Appendix 3I: Grouping of individual father, infant and interaction items of the GRS

Dimensions	Item clustering on the GRS	Definition
Father		
Good-Poor	*(i) Warm-Positive, (ii) Accepting-Rejecting, (iii) Responsive-Unresponsive, (iv)Demanding-Non-demanding, (v) Sensitive-Insensitive*	Measurement of the quality of paternal interaction on a scale of sensitive to insensitive
Intrusive	*(i)Non-intrusive-Intrusive, (ii) Non-intrusive-Intrusive speech*	Interruption of the infant's activity either verbally or through physical activity around the infant
Remote	*(i) Non-remote-Remote, (ii) Non-silent-Silent*	Psychological and verbal disengagement
Intrusive-Remote	*The difference between Intrusiveness and Remoteness is divided by two with a possible range of -2 (intrusive) - +2 (remote) and 0 representing the optimal state.*	
Depressive	*(i)Happy-Sad, (ii) Much energy –Low energy, (iii) Absorbed in the infant-Self-Absorbed*	Display of depressive affect, through sadness, slowness and focus on the self rather than the infant
Infant		
Good-Poor	*(i)Attentive-Avoidant, (ii) Active Communication-No communication, (iii) Positive vocalisations- No positive vocalisations*	Measurement of the quality of infant engagement
Inert	*(i)Engaged with the environment-Self-Absorbed, (ii) Lively-Inert*	Infant level of activity and interest in communicating
Fretful	*(i)Happy-Distressed, (ii) Non-fretful-Fretful*	Measurement of infant distress and irritability
Inert-fretful	The difference between Inert and Fretful is divided by two with a possible range of -2 (inertness) - +2 (fretfulness) and 0 representing normality	
Interaction		
Interaction	*(i)smooth-easy vs. difficult,(ii) fun vs. serious, (iii) mutually satisfying vs. unsatisfying, (iv) much engagement vs. no engagement and (v) excited engagement vs. quiet engagement*	Quality of the overall interaction between father and infant

Appendix 3J: Preliminary considerations of factor analyses

Factor analysis is a variable reduction procedure that allows one to explore interrelationships among variables in a dataset (McDade and Adair, 2001). The procedure aims to examine variables which cluster together in a meaningful way, measuring aspects of the same underlying dimension, known as a '*factor*'. The first factor explains the highest proportion of observed variance in the data set, the second factor accounting for the majority of variance not explained by factor 1 and so on. Factor loadings represent the degree of association (correlation coefficient) between an individual variable and a given factor with values in the range of -1 to +1. Typically an absolute value of more than .3 is considered by researchers (Field, 2005). Factors retained from an analysis are subject to a factor rotation used to discriminate between factors. Finally factor scores are computed for each participant on a particular factor.

The factor analytic procedure applied in the current study was *exploratory* aimed at identifying a set of latent variables, or factors that explain the covariance (the 'average' relationship) among the measured variables. An additional related use included the process of combining measured variables into summary indices. Thus we examined the factor structure of the father, infant and interaction scales of the GRS. For each scale, analysis was conducted twice: for data collected in the car seat context and for data collected in the floor mat context. Factor analysis was employed in an attempt to arrive at an alternate understanding of interactive behaviours in the context of paternal interactions. While most studies on early interactions using the GRS have focused on mothers and their infants, the use of

factor analyses would enable the data to suggest ways in which aspects of paternal and infant behaviours correlate differentially. We aimed to address the following questions: Which variables tend to cluster together within the father, infant and interaction scales of the GRS? Do the same sets of variables cluster together in the car seat context and in the floor mat context?

The following section addresses: (i) preliminary considerations made in assessing the date was appropriate for factor analysis and (ii) the decisions implemented in performing exploratory factor analysis

Preliminary considerations

Data screening

Firstly all the items to be factor analysed were administered to all the subjects to be included in the analysis. Secondly our assessment instrument, the GRS, consisted of likert-scaled items; rated on a 1-5 point scale. Factor analysis on such scales considered interval or quasi-interval can be performed adequately (Floyd et al., 1995). Thirdly we examined the correlation matrix (*R*-matrix) to check for variables which did not correlate with any other variables, those which correlated only with themselves, or those which correlated too highly ($R>.8$). We checked for multicollinearity within the data by looking at the determinant of the *R*-matrix which should be greater than .00001 (see e.g. below). Fourthly, we used the Bartlett's (1950) chi-square test (see e.g. below) to evaluate the correlation matrix. A significant test ($<.05$) implies that the *R*-matrix is not an identity matrix (when all correlation coefficients are zero) and hence the existing relationships between the variables can be analysed. Finally we checked for independence of measures of

individual items. Items that are methodologically dependent, may increase correlations and cause them to appear within the same factor (Tinsley and Tinsley, 1987). We identified one item, *sensitivity* as potentially problematic, being coded as a summary of the previous four paternal items. We ran analyses with and without the item and factor solutions were clearer without the inclusion of 'sensitivity'. Hence we deleted this item from further iterations in both contexts.

Sample size

The reliability of factor analysis depends on the sample size; as fluctuations in the correlation coefficients are evident in different samples and more so in small samples. Different views exist: 'the presence of 5-10 participants per variable- up to a total of 300 is adequate' (Kass and Tinsley, 1979), whereas others classify 100 participants as poor, 200, fair, 300, good; 500, very good (Comrey and Lee, 1992). Other researchers have challenged the above guidelines to suggest that a stable factor solution is indicated by the size of the factor loadings, along with the sample size and the number of indicators per factor (Guadagnoli et al., 1988, Arrindell et al., 1985). They suggest that with factor loading in the .60 range, stable solutions are obtained with samples greater than 150 or with smaller samples, each factor may constitute at least four items with loadings at .60. Hence we considered the number of factors that theoretically would be likely to emerge from the current scales (three and more), the size of the loadings (>.4) and the current samples (car seat context: 184; floor mat context 179) in determining the stability of our factor solutions. Additionally we used the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) to test the reliability of the factors (see e.g. below).

Procedures and decisions implemented

Since the decisions made at each stage of a factor analysis can have a substantial impact on the results of the analyses and subsequent interpretation of those results we focus on the following issues of techniques: (i) choice of the factor model, (ii) number of factors, (iii) factor rotation and finally (iv) the interpretation of factors and factor scores.

Factor model

We used the principal component analysis model. This model allowed us to examine all the variance of the observed variables (i.e. common, specific and error variance). In placing 1.0 in the main diagonal of the matrix, the factor loadings reflect all three types of variance; that which is shared with at least one other variable, variance which is unique to a single variable and unreliably measured variance unique to the variable. The method using the unweighted least squares method of estimating factors allowed for an extraction of factors that account for the maximum possible variance in the observed variables.

Factor extraction

Various criteria (Kaiser's criterion, Cattel's scree test, and variance accounted for by the factor solution) helped decide on the number of factors to retain in the solution. We selected a range of factor solutions considering all criteria before making a decision. For component analysis, it has been argued that Kaiser's criterion of retaining factors with eigenvalues (the amount of variance accounted for by the variable) greater than one appears appropriate (Ford et al., 1986). However,

because of the problems of both underestimation and overestimation (Zwick et al., 1986) of meaningful factors, we also employed Cattell's scree test. The scree-plot showed the slope of the line, connecting eigenvalues of unrotated factors. The cut-off for retaining factors was determined at the point at which the slope approached zero (i.e. a point at which the shape of the curve becomes horizontal), indicating that deleting a factor would no longer result in discarding significant variance (see e.g. below). Both these procedures provided similar number of factors. Since the scree test is subjective we also checked for variables that had significant factor loadings on the factor and also the number of variables per factor. Factors that explained a very small percentage of the variance were unlikely to provide theoretical and practical significance. The total and common variance explained by the factor solution, also helped in deciding the number of variables. Lastly we considered the number of maternal dimensions related to the scales in making a decision.

Thus we used a number of rules, examining a number of solutions prior to a decision. As suggested by Hakstian et al., (1982) for each scale within each context we used the highest to lowest number of factors until the most interpretable solution was found as discussed in the results section below (p.). Whilst using each decision method we were aware of the small numbers of items per analysis (fathers items=12, infant items=7, interaction items= 5), but it was evident that items with high loadings (.80) were likely to be retained by various decision methods. Another important consideration was the reliability of the extracted factors; we aimed to retain factors with three or more substantial loadings and an eigenvalue greater than one.

Factor rotation

Extracted factors were subsequently orthogonally rotated via the Varimax algorithm to provide greater interpretability. This allowed the spread of variances across factors a bit more equally as evident in the rotated factor matrixes. This choice of rotation facilitated the interpretation of the extracted factors by allowing a smaller number of variables to load on a factor. We additionally looked at oblique solutions for the data to allow correlations among the factors and the resulting solution was comparable to that resulting from the varimax procedure. The component correlation matrix for each scale using an oblique solution suggested that factors had little or no relationship with any other factors thus providing further evidence that it was reasonable to assume independence between factors.

Interpretation of factors and factor scores

We considered factor loadings greater than .40 in the interpretation of a factor (Floyd et al., 1995). Where variables did not have a substantial loading on any factor a decision was made to delete the item from further analysis and factor analysis was recomputed on the remaining subset of items. This step also ensured that the remaining factors accounted for a substantial proportion of the variance (50%). Another reason of eliminating variables was accounted for by weak communalities and hence eliminating the variable improved the overall factor solution. Factor labels provided a way of defining what constitutes the factor. Labels reflected a pattern of high and low loadings and their related valence. Positive loadings define the latent dimension underlying the construct, whereas a negative valence helps to clarify what the factor doesn't constitute. Items with higher loadings were given more weight in interpreting the factor.

We used two ways of determining factor scores. Using the approximate factor score strategy we summed the scores for all items which had a significant loading (>.4) on each factor, excluding items which had split loadings across more than one factor. This allowed each item to contribute to only one factor. Additionally we examined the scores produced by the *Bartlett method.* This method produced scores which correlate only with their own factor as opposed to the regression technique where scores are correlated even if an orthogonal method is applied. The two methods (summing significant item loadings and the Bartlett method) provided scores which were highly correlated and hence we choose to use the latter for further analysis.

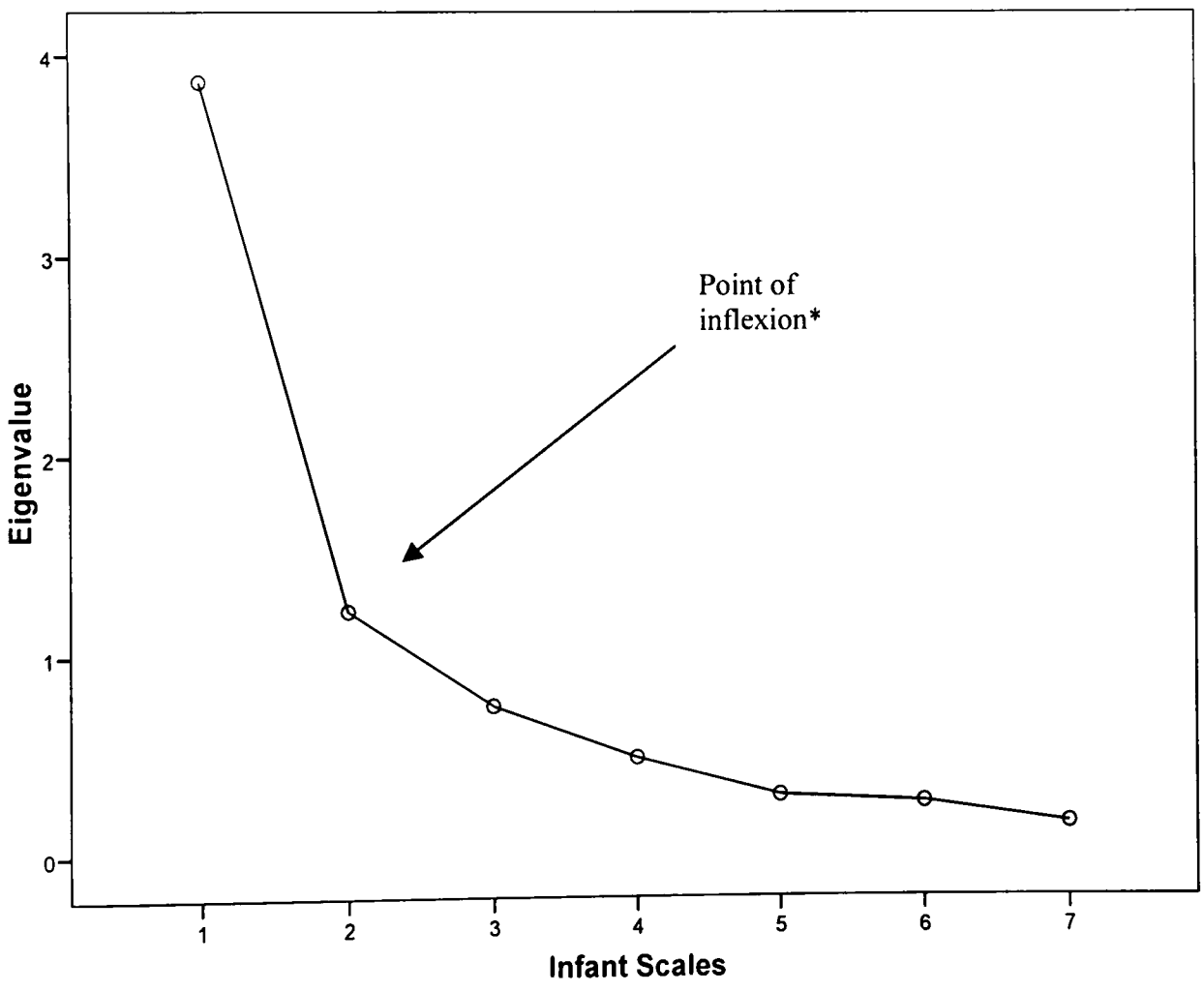
R-Matrix [a] - **Father scales of the GRS (Car seat)**

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Warm-Positive	1												
2. Accepting-rejecting	**.303****	1											
3. Responsive-unresponsive	-.007	.095	1										
4. Demanding-non-demanding	.064	**.179***	.123	1									
5. Sensitive-insensitive	**.310****	**.468****	**.485****	**.455****	1								
6. Non-intrusive-intrusive behaviour	.135	.097	**.213****	.057	**.406****	1							
7. Non-intrusive - intrusive speech	-.044	.065	**.459****	.025	**.280****	.134	1						
8. Non-remote-remote	.021	.028	**.160***	-.019	.099	-.046	-.114	1					
9. Non-silent-silent	.025	-.060	.071	-.105	.035	-.013	**-.182***	**.742****	1				
10. Happy-sad	**.171***	**.220****	.007	-.002	.095	-.065	**-.227****	**.552****	**.504****	1			
11. Much energy-low energy	.108	.181	-.005	-.005	.019	**-.171***	**-.308****	**.606****	**.628****	**.813****	1		
12. Absorbed in the infant-self-absorbed	.099	.120	**.188***	.109	.090	.058	-.029	.133	.068	**.182***	**.818***	I	
13. Relaxed-Tense	**.168***	**.158***	.112	-.059	**.213****	**.179***	.117	.075	.105	**.215****	.123	.132	1

Note: * $p < .05$, ** $p < .01$; [a]Determinant=.035 for the final solution

KMO and Bartlett's Test for father items of the GRS *(Car seat)*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.77
Bartlett's Test of Sphericity	Approx. Chi-Square	598.48
	df	45
	p-value	.000



Scree-plot examining factor extraction for the infant scales- *Car seat*
Note: * Data generated to fit a two-factor model using several criteria

Appendix 3K: Means and standard deviations *(SD)* of individual item ratings on the GRS (Car Seat)

	Depressed (n=19)	Non-depressed (n=97)	Total sample (n=116)
	Mean *(SD)*	**Mean *(SD)***	**Mean *(SD)***
Father items			
Warm - positive	3.32 (.89)	3.58 (.64)	3.58 (.72)
Accepting - Rejecting	3.32 (1.16)	3.65 (.94)	3.60 (.94)
Responsive - Unresponsive	3.63 (.90)	3.65 (.90)	3.61 (.95)
Demanding - Non-Demanding	3.84 (.90)	3.92 (1.11)	3.80 (1.12)
Sensitive - Insensitive	3.63 (.88)	3.30 (.86)	3.28 (.81)
Non-intrusive behaviour -Intrusive behaviour	3.63 (1.07)	3.61 (1.18)	3.55 (1.11)
Non-intrusive speech -Intrusive speech	4.31 (1.00)	4.14 (1.14)	4.18 (1.11)
Non-remote - Remote	4.58 (.90)	4.55 (.83)	4.55 (.85)
Non-silent - Silent	4.63 (.76)	4.54 (.98)	4.54 (.90)
Happy - Sad	3.32 (1.06)	3.72 (.93)	3.77 (.10)
Much energy - Low energy	3.84 (.83)	4.02 (.80)	4.03 (.82)
Absorbed in Infant - Self absorbed	3.90 (1.05)	4.22 (.83)	4.29 (.82)
Relaxed - Tense	3.58 (1.12)	3.58 (.93)	3.67 (.98)
Infant items			
Attentive - Avoidant	2.95 (1.03)	3.14 (1.33)	3.18 (1.28)
Active communication - No active communication	2.68 (1.20)	2.81 (1.08)	2.88 (1.09)
Positive vocalisation - No positive vocalisations	2.58 (1.39)	2.69 (1.22)	2.78 (1.24)
Engaged with the environment - self absorbed	3.42 (1.39)	3.77 (1.22)	3.75 (1.27)
Lively - Inert	3.15 (1.12)	3.16 (.90)	3.16 (.93)
Happy - Distressed	2.74 (1.10)	3.24 (1.03)	3.25 (1.04)
Non-fretful - Fretful	3.68 (1.33)	4.02 (1.04)	3.97 (1.11)
Interaction items			
Smooth-Difficult	3.00 (1.00)	3.21 (1.04)	3.26 (1.03)
Fun - Serious	2.58 (1.22)	2.78 (1.22)	.83 (1.19)
Mutually satisfying -unsatisfying	2.79 (1.23)	2.90 (1.31)	3.00 (1.33)
Much engagement - No engagement	2.84 (1.12)	2.97 (1.16)	3.00 (1.17)
Excited engagement - Quiet engagement	3.00 (.97)	2.87 (1.00)	2.95 (.97)

Appendix 3L: Correlations between father, infant and interaction items of the GRS: *Car seat*

Father	1	2	3	4	5	6	7	8	9
1.Warmth	1								
2. Acceptance	**.30****	1							
3. Responsive	-.01	.10	I						
4. Non-demanding	.06	**.18***	.I2	1					
5. Sensitive	**.31****	**.47***	**.49****	**.46****	1				
6. Non-intrusive behaviour	.14	.10	**.21****	.06	**.41****	1			
7. Non-intrusive speech	-.04	.07	**.46****	.03	**.28****	.13	1		
8. Non-remote	.02	.03	**.16***	-.02	.10	-.05	-.1I	1	
9. Non-silent	.03	-.06	.07	-.11	.04	-.01	-.18*	**.74****	I

Appendix 3Lcontinued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
10. Happy	**.17***	**.22****	.01	-.00	.10	.07	**-.23****	**.53****	**.50****	1															
11. Much energy	.11	**.18***	-.01	-.01	.02	**-.17***	**-.13****	**.61****	**.63****	**.81****	1														
12. Absorbed in infant	.10	.12	**.19***	.11	.10	.06	-.03	.13	.07	**.18***	**.18***	1													
13. Relaxed	**.17***	**.16***	.11	-.06	**.21****	**.18***	.12	.08	.11	**.22****	.12	.13	1												
Infant																									
14. Attentive	.05	.16*	-.10	.13	.14	-.08	**-.26****	**.20****	**.22****	**.30****	**.32****	.14	.08	I											
15. Active communication	.02	**.16***	**-.15***	.07	.07	-.04	**-.35****	**.17***	**.18***	**.25****	**.24****	.14	.10	**.69****	1										
16. Positive vocalisations	.13	**.14**	**-.18***	.07	.05	.09	**-.42****	.12	**.17***	**.21****	**.15***	.14	.13	**.55****	**.80****	1									
17. Engaged	**.16***	**.36****	-.07	.13	**.23****	-.08	**-.20****	.10	.11	**.23****	**.27****	.14	**.16***	**.62****	**.64****	**.54****	1								

Appendix 3L continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
18. Lively	.00	.05	.03	.08	.09	.12	-.02	.12	.13	.01	.12	**.16** *	-.02	.08	**.22** **	**.20** **	**.26** **	1							
19. Happy	.04	**.33** **	-.07	.10	**.18** *	-.11	**-.23** **	.09	.12	**.30** **	**.31** **	.08	.08	**.60** **	**.72** **	**.56** **	**.70** **	.13	1						
20. Non-fretful	.03	**.41** **	.06	.07	**.28** **	-.08	-.01	-.06	-.10	.11	.07	.01	**.17** *	**.30** **	**.36** **	**.22** **	**.49** **	**-.20** **	**.58** **	1					
Interaction																									
21. Smooth	.05	**.25** **	.03	**.18** *	**.25** **	.07	**-.21** **	**.26** **	**.25** **	**.38** **	**.36** **	.14	.13	**.65** **	**.74** **	**.67** **	**.66** **	**.17** *	**.75** **	**.47** **	1				
22. Fun	.04	**.29** **	-.07	.12	**.15** *	-.10	**-.30** **	**.23** **	**.24** **	**.44** **	**.42** **	**.18** *	.12	**.67** **	**.80** **	**.68** **	**.79** **	**.16** *	**.81** **	**.50** **	**.81** **	I			
23. Mutually satisfying	.07	**.25** **	-.05	**.15** *	**.19** *	-.07	**-.28** **	**.23** **	**.21** **	**.40** **	**.38** **	**.20** **	.14	**.74** **	**.83** **	**.70** **	**.71** **	.13	**.78** **	**.46** **	**.85** **	**.90** **	1		
24. Much engagement	.01	**.26** **	-.10	.06	.10	-.07	**-.33** **	**.28** **	**.26** **	**.40** **	**.41** **	**.16** *	.06	**.70** **	**.84** **	**.70** **	**.66** **	**.17** *	**.74** **	**.43** **	**.78** **	**.82** **	**.89** **	1	
25. Excited engagement	.05	.12	-.10	.11	.09	-.02	**-.32** **	**.18** *	**.17** *	**.36** **	**.31** **	.04	**.16** *	**.62** **	**.78** **	**.77** **	**.57** **	**.18** *	**.66** **	**.30** **	**.74** **	**.81** **	**.80** **	**.81** **	1

Note: *$p<.05$, **$P<.01$

Appendix 3M: Differences between males and females (Car seat)

Mean GRS summary scores in for the interactions of male and female infants *(Car Seat)*

GRS dimensions	Males (n=87) Mean *(SD)*	Females (n=97) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.55 (.56)	3.59 (.59)	-.33	.739
Intrusive-Remote	-.38 (.64)	-.30 (.60)	-1.03	.301
Intrusive Scale	3.78 (.86)	3.95 (.81)	-1.47	.143
Remote Scale	4.53 (.82)	4.56 (.82)	-.21	.835
Depressive Scale	3.95 (.62)	3.93 (.61)	-.17	.863
Infant dimensions				
Good-Poor	2.93 (1.02)	2.96 (1.11)	-.06	.953
Inert-Fretful	-.15 (.41)	-.10 (.46)	-1.03	.305
Inert Scales	3.34 (.87)	3.38 (.90)	-.58	.564
Fretful Scales	3.65 (.96)	3.58 (.96)	-.44	.660
Interaction dimension				
Interaction Scale	3.02 (1.09)	2.94 (1.07)	-.40	.692

Mean scores on factor analysed dimensions in the interactions of male and female infants *(Car Seat)*

GRS dimensions	Males (n=87) Mean *(SD)*	Females (n=97) Mean *(SD)*	*Z*	*p*-value
Father factors				
Engagement	.04 (1.01)	-.03 (.99)	-.83	.406
Directive responsiveness	-.10 (.96)	.09 (1.03)	-1.50	.133
Sensitivity	.01 (.92)	-.01 (1.07)	-.01	.991
Infant factors				
Positive Communication	4.36 (20.43)	3.91 (19.43)	-.07	.947
Positive Affect	4.38 (20.43)	3.90 (19.43)	-.77	.444
Interaction factor				
Dyadic interaction	.04 (1.00)	-.04 (.10)	-.40	.692

Appendix 3N: Gender differences in depressed and non-depressed groups (Car seat)

Mean scores on summary scales of the GRS in the two study groups based on infant gender *(Car Seat)*

Females

GRS dimensions	Non-depressed (N=54) Mean *(SD)*	Current depression (N=12) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.62 (.56)	3.55 (.68)	-.18	.854
Intrusive-Remote	-.30 (.65)	-.40 (.42)	-.44	.661
Intrusive Scale	4.00 (.87)	4.00 (.64)	-.30	.766
Remote Scale	4.60 (.84)	4.79 (.58)	-.81	.417
Depressive Scale	3.87 (.56)	3.75 (.83)	-.01	.993
Infant dimensions				
Good-Poor	3.01 (1.10)	2.42 (1.07)	-1.60	.110
Inert-Fretful	-.12 (.35)	.01 (.52)	-1.18	.239
Inert Scales	3.41 (.82)	2.94 (1.06)	-1.43	.154
Fretful Scales	3.65 (.90)	2.92 (1.24)	-1.73	.084
Interaction dimension				
Interaction Scale	2.96 (1.08)	2.58 (1.05)	-1.07	.286

Males

GRS dimensions	Non-depressed (N=43) Mean *(SD)*	Current depression (N=7) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.61 (.51)	3.34 (.56)	.22	.235
Intrusive-Remote	-.37 (.67)	-.18 (.84)	.56	.584
Intrusive Scale	3.72 (.93)	3.93 (.93)	.63	.642
Remote Scale	4.47 (.84)	4.29 (1.07)	.70	.743
Depressive Scale	3.90 (.65)	3.50 (.41)	.08	.083
Infant dimensions				
Good-Poor	2.73 (1.04)	3.29 (.85)	.11	.119
Inert-Fretful	-.16 (.41)	-.07 (.42)	.75	.763
Inert Scales	3.29 (.93)	3.57 (.67)	.50	.510
Fretful Scales	3.60 (.92)	3.71 (.57)	.90	.913
Interaction dimension				
Interaction Scale	2.86 (1.11)	3.14 (.96)	.51	.528

Mean scores on factor analysed scores in the two study groups based on infant gender *(Car Seat)*

Females				
	Non-depressed (N=54)	**Current depression (N=12)**		
GRS dimensions	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Father factors				
Engagement	-.02 (1.00)	.11 (.82)	-.37	.715
Directive responsiveness	.08 (1.06)	.43 (.84)	-1.08	.280
Sensitivity	.11 (.96)	-.43 (1.44)	-.10	.319
Infant factors				
Communication	.06 (1.01)	-.64 (1.18)	-1.78	.075
Affect	-.08 (.84)	.21 (1.31)	-.98	.327
Interaction factor				
Dyadic interaction	-.07 (1.03)	-.14 (.86)	-.12	.901

Males				
	Non-depressed (N=43)	**Current depression (N=7)**		
GRS dimensions	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Father factors				
Engagement	-.01 (.97)	-.56 (1.21)	.19	.203
Directive responsiveness	-.05 (.98)	-.26 (.85)	.53	.546
Sensitivity	.00 (.84)	-.38 (1.11)	.38	.394
Infant factors				
Communication	-.13 (1.00)	.27 (.61)	.19	.203
Affect	.03 (.97)	.09 (1.04)	.88	.891
Interaction factor				
Dyadic interaction	-.07 (.10)	.01 (.99)	.89	.890

Appendix 3O: Correlations between father, infant and interaction items of the GRS: *Floor mat*

Father	1	2	3	4	5	6	7	8	9
1.Warmth	1								
2. Acceptance	.14	1							
3. Responsive	.11	**.27** **	1						
4. Non-demanding	.04	.12	.08	1					
5. Sensitive	**.33** *	**.46** **	**.62** **	**.39** **	1				
6. Non-intrusive behaviour	**.21** *	.05	.13	**.32** **	**.45** **	1			
7. Non-intrusive speech	.01	**.19** *	**.53** **	-.11	**.33** **	.11	1		
8. Non-remote	**.27** **	.13	-.00	-.04	-.01	**-.20** *	**-.28** **	1	
9. Non-silent	**.19** *	.09	.08	-.05	-.05	-.16	**-.23** *	**.76** **	1

Appendix 30 continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
10. Happy	**.27** **	.15	.09	.12	.04	-.14	**-.21** *	**.64** **	**.58** **	1															
11. Much energy	**.20** *	.18	.02	.02	-.12	**-.28** **	**-.30** **	**.64** **	**.64** **	**.76** **	1														
12. Absorbed in infant	-.13	.15	.14	.03	**.21** *	**.24** *	.15	.03	-.06	.01	-.07	1													
13. Relaxed	-.01	**.21** *	**.22** *	.01	**.25** **	-.03	.18	.03	.11	.08	.07	**.21** *	1												
Infant																									
14. Attentive	.19	**.32** **	.03	**.21** *	.15	**-.26** **	-.06	**.26** **	**.23** *	**.19** *	**.26** **	-.08	.03	1											
15. Active communication	**.21** *	.15	-.02	**.21** *	.11	-.05	-.14	.12	.13	.19	.16	-.07	-.06	**.68** **	1										
16. Positive vocalisations	.06	-.03	-.13	**.31** **	.01	-.01	**-.37** **	.08	.11	**.20** *	.18	.01	-.07	**.45** **	**.73** **	1									
17. Engaged	**.21** *	**.21** *	.15	.11	.15	-.09	.11	.11	.01	.09	.02	-.17	.04	**.51** **	**.61** **	**.39** **	1								

Appendix 30 continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
18. Lively	.08	-.05	-.07	.01	-.07	.01	-.12	.07	.12	.14	.13	-.05	-.07	**.36** **	**.69** **	**.55** **	**.44** **	1							
19. Happy	.15	**.20** *	.06	.15	.12	-.07	.01	.10	.08	.25	**.21** *	.04	.10	**.42** **	**.57** **	**.46** **	**.53** **	**.39** **	I						
20. Non-fretful	**.25** **	.17	**.22** *	.01	**.24** *	-.08	**.30** **	.01	.01	.07	.04	-.10	.03	**.30** **	**.28** **	.12	**.45** **	.03	**.42** **	1					
Interaction																									
21. Smooth	**.27** **	**.24** *	.11	**.21** *	**.21** *	-.09	-.11	**.23** *	**.19** *	**.27** **	**.31** **	-.00	.08	**.65** **	**.80** **	**.64** **	**.58** **	**.51** **	**.67** **	**.40** **	I				
22. Fun	**.23** *	**.21** *	.01	**.33** **	**.24** *	.01	**-.19** *	**.24** *	.16	**.35** **	**.31** **	.08	.07	**.62** **	**.75** **	**.66** **	**.57** **	**.51** **	**.75** **	**.27** **	**.83** **	1			
23. Mutually satisfying	**.20** *	**.20** *	.07	**.29** **	**.20** *	-.04	-.13	.18	.18	.26	**.28** **	.00	.04	**.71** **	**.86** **	**.68** **	**.60** **	**.54** **	**.65** **	**.35** **	**.90** **	**.88** **	1		
24. Much engagement	**.25** **	**.21** *	.04	**.30** **	**.23** *	-.06	-.13	**.25** **	**.20** *	**.33** **	**.30** **	-.02	.03	**.74** **	**.84** **	**.65** **	**.59** **	**.57** **	**.63** **	**.31** **	**.84** **	**.84** **	**.91** **	1	
25. Excited engagement	.15	-.01	-.05	**.27** **	.08	.01	**-.31** **	.16	.13	**.23** *	**.27** **	.05	.08	**.43** **	**.70** **	**.77** **	**.47** **	**.57** **	**.65** **	.10	**.75** **	**.83** **	**.76** **	**.74** **	I

Note: *p<.05, **P<.01

Appendix 3P: Means and standard deviations *(SD)* of individual item ratings on the GRS-Floor mat

	Depressed (n=17)	Non-depressed (n=93)	Total sample (n=110)
	Mean *(SD)*	**Mean *(SD)***	**Mean *(SD)***
Father items			
Warm - positive	3.82 (.73)	3.57 (.65)	3.66 (.67)
Accepting - Rejecting	3.65 (.10)	3.68 (.87)	3.5 (.89)
Responsive - Unresponsive	3.18 (1.13)	3.56 (.88)	3.50 (.96)
Demanding - Non-Demanding	4.24 (.75)	4.22 (.10)	4.19 (.99)
Sensitive - Insensitive	3.35 (.87)	3.37 (.88)	3.44 (.83)
Non-intrusive behaviour -Intrusive behaviour	3.71 (.92)	3.22 (1.11)	3.36 (1.07)
Non-intrusive speech -Intrusive speech	4.24 (.90)	3.95 (1.28)	4.07 (1.15)
Non-remote - Remote	4.24 (.97)	4.61 (.77)	4.60 (.80)
Non-silent - Silent	4.18 (1.13)	4.58 (.85)	4.59 (.88)
Happy - Sad	3.18 (1.19)	3.89 (.94)	3.81 (.96)
Much energy - Low energy	3.59 (.87)	4.09 (.72)	4.02 (.78)
Absorbed in Infant - Self absorbed	4.71 (.59)	4.42 (.66)	4.51 (.63)
Relaxed - Tense	3.59 (.94)	3.73 (.98)	3.74 (.97)
Infant items			
Attentive - Avoidant	3.65 (1.17)	3.44 (1.33)	3.61 (1.32)
Active communication - No active communication	3.47 (1.33)	3.34 (1.26)	3.42 (1.24)
Positive vocalisation - No positive vocalisations	3.29 (1.26)	3.27 (1.14)	3.32 (1.14)
Engaged with the environment - self absorbed	4.19 (1.05)	4.49 (1.03)	4.44 (1.03)
Lively - Inert	3.65 (1.27)	3.80 (.90)	3.82 (.94)
Happy - Distressed	3.35 (.79)	3.31 (.88)	3.32 (.86)
Non-fretful - Fretful	4.53 (.80)	4.42 (.91)	4.44 (.93)
Interaction items			
Smooth-Difficult	3.53 (1.23)	3.68 (.99)	3.74 (1.00)
Fun - Serious	3.00 (1.22)	3.21 (1.15)	3.25 (1.12)
Mutually satisfying -unsatisfying	3.29 (1.36)	3.46 (1.32)	3.55 (1.31)
Much engagement - No engagement	3.41 (1.28)	3.51 (1.30)	3.61 (1.29)
Excited engagement - Quiet engagement	3.00 (1.06)	3.20 (.90)	3.21 (.91)

Appendix 3Q: Differences between males and females (Floormat)

Mean GRS summary scores in for the interactions of male and female infants *(Floor Mat)*

GRS dimensions	Males (n=85) Mean *(SD)*	Females (n=94) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.74 (.57)	3.6 (.54)	-.71	.479
Intrusive-Remote	-.42 (.63)	-.45 (.63)	-.19	.853
Intrusive Scale	3.77 (.81)	3.67 (.78)	-.88	.379
Remote Scale	4.62 (.82)	4.57 (.80)	-.94	.347
Depressive Scale	4.06 (.54)	3.98 (.52)	-.91	.362
Infant dimensions				
Good-Poor	3.44 (1.10)	3.47 (1.05)	-.08	.934
Inert-Fretful	.03 (.36)	.06 (.34)	-.40	.689
Inert Scales	4.01 (.86)	3.94 (.81)	-.90	.370
Fretful Scales	3.95 (.82)	3.82 (.78)	-1.59	.112
Interaction dimension				
Interaction Scale	3.53 (1.08)	3.38 (1.04)	-1.03	.305

Mean scores on factor analysed dimensions in the interactions of male and female infants *(Floor Mat)*

GRS dimensions	Males (N=54) Mean *(SD)*	Females (N=12) Mean *(SD)*	*Z*	*p*-value
Father factors				
Engagement	6.57 (24.71)	6.82 (25.30)	-.60	.550
Infant directed communication	6.55 (24.72)	6.84 (25.29)	-.45	.651
Infant focused physicality	6.01 (24.70)	6.79 (25.31)	-.10	.318
Infant factors				
Positive Affect	9.83 (29.72)	7.81 (26.90)	-.94	.346
Active Communication	9.85 (29.71)	7.79 (26.90)	-.99	.323
Interaction factor				
Dyadic interaction	.07(1.03)	-.07 (.97)	-1.08	.282

Appendix 3R: Gender differences in depressed and non-depressed groups (Floormat)

Mean scores on summary scales of the GRS in the two study groups based on infant gender *(Floor Mat)*

Females

GRS dimensions	Non-depressed (N=54) Mean *(SD)*	Current depression (N=12) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.65 (.49)	3.65 (.59)	-.04	.970
Intrusive-Remote	-.57 (.60)	-.16 (.75)	-1.54	.125
Intrusive Scale	3.5 (.90)	3.86 (.60)	-1.10	.271
Remote Scale	4.65 (.61)	4.18 (1.01)	-1.32	.188
Depressive Scale	4.00 (.50)	3.75 (.61)	-1.14	.255
Infant dimensions				
Good-Poor	3.55 (1.05)	3.33 (1.09)	-.64	.522
Inert-Fretful	.10 (.36)	-.11 (.35)	-1.76	.078
Inert Scales	4.08 (.78)	3.55 (1.00)	-1.80	.072
Fretful Scales	3.88 (.77)	3.77 (.61)	-.72	.474
Interaction dimension				
Interaction Scale	3.49 (.10)	2.91 (1.14)	-1.64	.102

Males

GRS dimensions	Non-depressed (N=43) Mean *(SD)*	Current depression (N=7) Mean *(SD)*	*Z*	*p*-value
Father dimensions				
Good-Poor	3.71 (.60)	3.63 (.71)	-.11	.915
Intrusive-Remote	-.43 (.71)	-.04 (.80)	-1.11	.28
Intrusive Scale	3.68 (.90)	4.17 (.75)	-1.39	.180
Remote Scale	4.54 (.90)	4.25 (1.17)	-.30	.820
Depressive Scale	4.07 (.56)	3.79 (.51)	-.10	.335
Infant dimensions				
Good-Poor	3.11 (1.10)	3.72 (1.02)	-1.29	.213
Inert-Fretful	-.04 (.39)	.15 (.14)	-1.27	.220
Inert Scales	3.77 (.86)	4.60 (.55)	-2.09	**.039**
Fretful Scales	3.85 (.88)	4.25 (.52)	-1.09	.305
Interaction dimension				
Interaction Scale	3.27 (1.15)	3.87 (1.01)	-1.21	.237

Mean scores on factor analysed scores in the two study groups based on infant gender *(Floor Mat)*

Females				
	Non-depressed (N=54)	**Current depression (N=12)**		
GRS dimensions	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Father factors				
Engagement	.10 (.77)	-.57 (1.30)	-1.17	.243
Directive responsiveness	.03 (.96)	-.16 (1.10)	-.62	.533
Sensitivity	-.31 (.95)	.25 (1.07)	-1.50	.134
Infant factors				
Active Communication	-.01 (.96)	-.36 (1.47)	-.75	.453
Positive Affect	.076 (.95)	-.13 (.82)	-.94	.348
Interaction factor				
Dyadic interaction	.04 (.89)	-.70 (1.19)	-2.05	**.041**

Males				
	Non-depressed (N=43)	**Current depression (N=7)**		
GRS dimensions	**Mean *(SD)***	**Mean *(SD)***	***Z***	***p*-value**
Father factors				
Engagement	.03 (1.08)	-.72 (1.50)	.11	.117
Directive responsiveness	-.08 (1.17)	-.22 (.94)	.49	.512
Sensitivity	.06 (1.08)	.43 (.87)	.44	.455
Infant factors				
Active Communication	-.07 (1.06)	.60 (.79)	.16	.170
Positive Affect	-.08 (1.07)	.28 (.59)	.43	.449
Interaction factor				
Dyadic interaction	-.18 (1.13)	.31 (1.04)	.39	.404

Appendices for chapter 4

Appendices- 4A-4D

Appendix 4A: Manual for coding paternal behaviours

Paternal-Physicality Affect and Touch Scale (P-PATS)

Coding manual for the P-PATS, Oxford Fathers Project, 2008: [*Version IV*]

1. Tactile stimulation–*Frequency of touch*

This scale captures the amount of time the parent spends in physical contact with the infant. This may include laying a hand on or stroking the infant's limbs or upper body or on the face or neck. The quality of touch may vary from resting a hand on the infant, stroking or caressing the infant, gentle poking to get the infant's attention to more vigorous physical touch to rouse the infant in the context of a game. To score this dimension rate the proportion of the interaction during which the parent touches the infant either as part of a game, to gain or maintain the infant's attention, as an affectionate gesture or in response to the infant's physical movements. It is evident that most parents reach out to touch the infant; and hence this dimension is a sum of the amount of time spent in physical contact with the infant over the course of 3-minutes. A remote parent would interact with the infant using minimal touch as opposed to a parent who is actively engaging the infant with frequent physical interaction.

Much Touch (5)---------- Little Touch (1)

5. The parent spends all or nearly all of the interaction in physical contact with the infant.

4. The parent spends a great deal of the time (about ¾) in physical contact with the infant or for period totally about ¾ of the time.

3. The parent spends about ½ the time in physical contact with the infant or in brief periods totalling about ½ the time.

2. The parent touches the infant a few times, totalling about a ¼ of the time.

1. Rarely does the parent make physical contact with the infant.

2. Tactile stimulation –*Quality of touch*

In this dimension we move beyond the effects of the presence versus absence of touch to the quality of touch. *What types of touch do fathers utilize in their interactions?* The categories of touch developed were defined by The Touch Scoring Instrument (Polan & Ward, 1994) and the Quality of touch measure used by Moreno et al., (2006). Episodes of touch are differentiated by: (i) a change in the type of touch used (ii) moving hands away from the infant (for more than 3 sec.) to signal a new episode before re-contact (iii) end of a particular behaviour/game segment contextualizing touch. Touching a different body part utilizing the same touch type would be counted as one episode.

Additionally under this dimension we code for nature of touch as being positive or negative. This is identified by the infant's response to tactile stimulation. Positive touch would elicit a positive reaction from the infant defined by an increase in the infant's social behaviour; attention (eye-contact) and positive affect (smiles, vocalisations, increased movement of limbs). Negative touch elicits a negative reaction from the infant which includes changes in his/her attention focus, startling, frowning, fussing, grunting, brow lowering, pouting, fretfulness and agitated body posture and negative vocalisations. Neutral touch doesn't elicit a reaction from the infant as being negative or positive.

Within each category defined below we identify: (i) the frequency of touch used by fathers over the three minute interaction and (ii) the total time spent using a particular type of touch across the entire three minutes.

Type of touch	Frequency: Number of episodes	Total time within each touch category	Proportion of time
Inactive touch			
Light touch			
Firm touch			
Stimulating touch			
Active touch			
Practical touch			

Types of touch defined for this dimension

1. Inactive touch: *Resting the hand passively* by or on the infant's body and *unmoving.*

2. Light touch: Laying a hand on the infant's face and neck, gentle affectionate kissing or stroking or tickling with fingertips to get the infants attention. Holding/touching the infants hands, feet with the *tips of the fingers.*

3. Firm touch: Using the *whole hand* to firmly stroke, pat or touch the infant's arms, legs and torso region.

4. Stimulating touch: 'Flexion-extension' of the infant's limbs, folding and extending limbs or *movement of limbs* back and forth in the context of a game.

5. Active touch: Touching the infant and *moving the infant's body* from side to side resulting in a change in infant's positioning or lifting the infant off the mat.

6. Practical touch: Touching the infant for a *purpose*; for e.g. to wipe the infant's face or pulling up socks. Practical behaviours performed in an affectionate or stimulating way may override the code for practical touch.

3. Affective synchrony: *Frequency of matched smiles*

Synchrony is the process through which 'partners move in a coordinated fashion toward increased or decreased interactive involvement and positive arousal'. This dimension captures a dyadic level of positive emotional ambience in the father-infant relationship by exploring the mutually positive experience of smiling. The matching of positive states in the father-infant dyad is studied through smiling, a facial action expressing pleasure in the context of face-to-face interactions. Coordinated smiles between father and infant are recorded when both members of the dyad share a positive affective experience, i.e., 'smiling' initiated by either member of the dyad.

For the purpose of identification and coding the following variations in infant expression are coded under this scale when they are clearly evident on the screen. Ambiguous facial movements are not coded under this dimension for either member of the dyad:

1. *Simple smiles*: The contraction of the corners of the lips.
2. *Duchenne smiles*: Contraction of the lip corners, cheek raises followed by contraction of the muscles around the eyes
3. *Play smiles*: Jaw dropping accompanied by wide-mouth opening, in times of intense laughter
4. *Duplay smiles*: Dropping of the jaw, lip corner raising, cheek raise, accompanied by high pitched vocalisations, laughs, squeals and yells

Many coordinated smiles (5)----------No coordinated smiles (1)

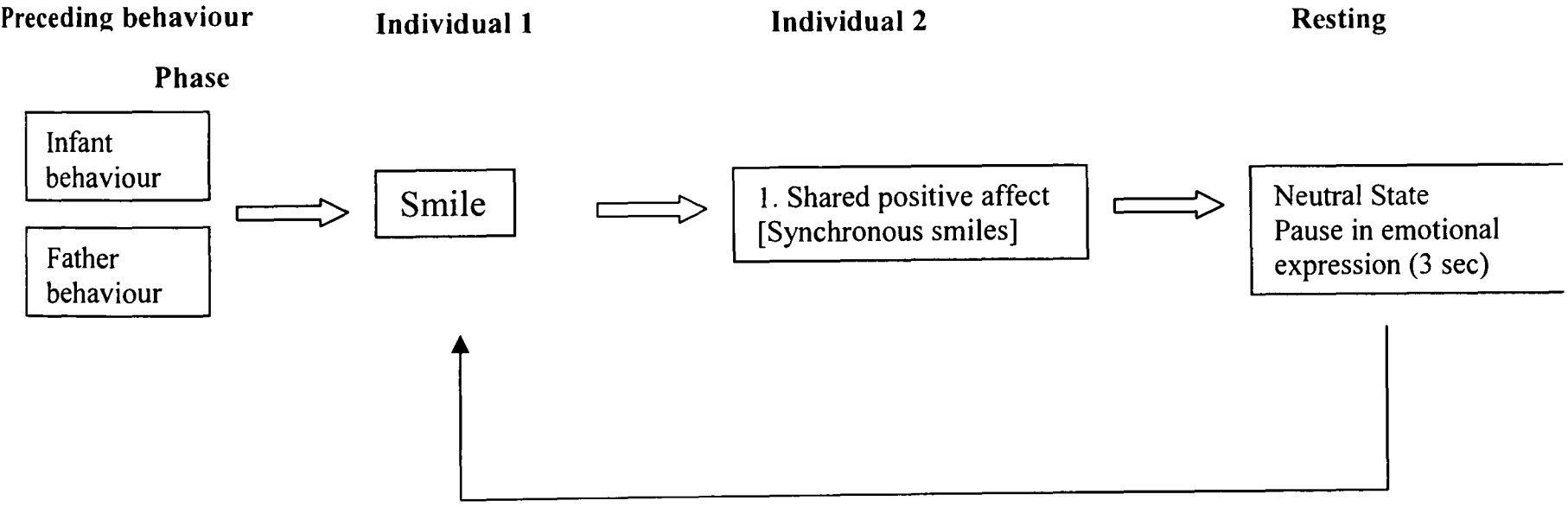
5. Father and infant smile together many times (on 7 or more occasions).
4. Several coordinated smiles occur between father and infant (5-6 occasions).
3. Father and infant smile together a few times (on 3 or 4 occasions).
2. Father and infant smile together briefly 1-2 times during the interaction.
1. There is no exchange of positive coordinated affect between father and infant.

4. Affective synchrony: *Lead-Lag relations*

This parameter of synchronous social interactions addresses the question of *who initiates change in positive affective state (smiling).* Does the father initiate this change in the infant as a result of his facial expression (smile) or does the infant initiate a change in the father who follows the infant's lead?

To code under this dimension simply count the frequency of father driven or infant driven synchronous smiles or episodes of smiling. Regardless of behavioural or verbal communication preceding a smile, this dimension aims to determine which partner in the dyad (father or infant) makes the first move towards smiling. This initiated smile may lead to an episode of matched positive affect or initiate a change in affective state from neutral to positive in the other member of the dyad. This sequence being followed by a 'resting phase' defined as going back to the neutral or normal emotional state prior to the identification of the next smile. A minimum of 3 seconds determines the gap between exchanges.

The following illustrates the coding sequence for this dimension.



	Father driven	**Infant driven**
Frequency of synchronous smiles		

5. Physicality in play: Gross motor stimulation

This scale taps into the physicality of father-infant play. Defined as Rough and Tumble Play (RTP) in toddlerhood, we aim to examine kinaesthetic stimulation in father-infant play at 3-months. This stimulation includes movement of body position, or movement of limbs. Fathers tend to engage in physical play involving *gross motor stimulation*, which characterises their interaction as being, 'wilder and physically more rambunctious'. This scale aims to describe the physical aspect of fathers play to distinguish it from the quieter verbal interactions of mothers. We code paternal behaviours from gross motor energetic stimulation to low-energy physical stimulation. Coding is based on progressive levels of physicality: (i) touch and holding of limbs, (ii) Movement of limbs only, (iii) Movement of limbs and the infant's body

Much Physicality in play (5)----------Little Physicality in play (1)

5. The parent *lifts the infant off the mat* and or pulls the infant up in a *sitting position* by means of their arms or legs. There is movement of the infant's limbs during play and a *change in the infant's body positioning.* Episodes of *moving the infant's upper body* off the mat are coded under this rating.

4. The parent rolls the infant's body on the mat, moves the infant from *from side to side*, or moves the infant's lower body off the mat. As in rating 5 there is movement of the arms and legs.

3. The parent *rigorously shakes* the infant's limbs up and down or side to side. The infant's positioning on the floor mat remains unchanged.

2. The parent uses gentle physical stimulation He *holds and lightly moves the infant's limbs only*.

1. Rarely does the parent engage in physical play. The parent *touches and or holds* the infant's toes/legs or fingers/arms.

6. Excitatory arousal

This scale taps into specific paternal behaviours during free-play which startle and arouse the infant and are inconsistent with the infant's ongoing activity and expectations. On this dimension we code for specific instances of paternal behaviour which include unpredictable movements within the infant's visual field, and a change in pitch and volume of voice quality which stimulate and arouse the infant. Behaviours which take the infant 'out of their comfort zone', as part of a game, initiated by the parent or in response to the infant are coded where the infant is excited by the parent rather than contained. The coder seeks specific aspects of communication which contribute to a sudden change in the play sequence and are ambiguous requiring infant interpretation. These include a change in (i) tone of voice, (ii) proximity to the infant, (iii) physical activity or distal stimulation by motor movements visually observed by the infant, (iv) facial expression, (v) game playing (hiding face/fingers) (vi) exclamations and (vii) sudden laughs.

Two features of excitatory arousal used in the interpretation of this scale are; '*emotional content'* and '*short repetitive sequences or a single event'*. The important aspect of this dimension is not merely an identification of stimulating, novel behaviours which disrupt the smooth flow of the interaction rather *the way in which they are interpreted by the infant.* The infant's response of surprise, startle and increased or decreased engagement may enable us to identify the arousing/orienting paternal behaviours during interaction.

Nature & frequency [Inclusion criteria: Sudden, emotional, unpredicted, repetitive short sequences, or a single verbal/non-verbal action]		**Infants response** [Inclusion: Startle, surprise, sudden arrest of behaviour leading to either positive or negative affect and communication]	
Time	**Nature of activity**	**For 5 sec. before**	**For 5 sec. after**

Sequence of behaviours measured during excitatory arousal

IDENTIFY INFANT'S STATE PRIOR TO BEHAVIOUR – 5 SEC BEFORE THE EXCITATORY BEHAVIOUR

1. Positive affect/ positive communication/attentive i.e. gaze directed towards the father
2. Negative affect/negative communicating i.e. distress/attentive or inattentive
3. Neutral affect attentive
4. Neutral affect inattentive i.e. gaze directed away from the father

↓

PATERNAL AROUSAL

Nature of destabilizing behaviour:

1. Vocalisation (sudden laughs, exclamations, animation, high pitched verbalization)
2. Distal stimulation by motor movements visually observed by the infant + vocalisation
3. Movement towards infant (physical activity in close proximity)
4. Movement towards infant (physical activity in close proximity)+ vocalisation
5. Animated noises + Use of hands + Movement around infant

↓

INFANTS STARTLE RESPONSE

↓

Infant's state FOR 5 sec after THE EXCITATORY behaviour

1. Positive affect/positive communication/attentive
2. Negative affect/negative communicating i.e. distress/attentive or inattentive
3. Neutral affect attentive
4. Neutral affect inattentive

7. Active engagement

This dimension aims to capture the 'degree of interest and excitement that a father has available to bring to interactions with his infant'. Paternal sensitivity, active engagement and stimulation are included in this dimension. The level of vitality and liveliness within the session are coded through paternal behaviour, affect, facial expression and tone of voice. This dimension taps into the vocal, emotional, psychological and physical availability of the parent; in that the father communicates through his ongoing behaviour, vocal and facial expressions that he is aware of the infant's presence, is receptive to the ongoing interaction and is available to respond or initiate communication empathically and appropriately. Stimulation is a reflection of the effort the father puts into the interaction to create a lively, vigorous environment as opposed to a quiet and contained one.

The coder identifies aspects of stimulation defined below:

- **Vocal stimulation**
    1. Increased pitch, rate and tempo of speech
    2. Variability in voice frequency and pitch
    3. Animated sounds
    4. Using speech to communicate to the infant
    5. Using speech in the context of a game
- **Physical stimulation**
    1. Physical orientation and movement around the infant
    2. Use of touch
    3. Game-playing using hands
- **Emotional stimulation**
    1. Varied facial expression
    2. Exchange of positive emotions through smiling
- **Psychological stimulation**
    1. Responding to the infant
    2. Talking about the infant more and self less

Much stimulation (5)----------Little stimulation (1)
[Lively/charged] [Quiet/contained]

5. The parent is stimulating throughout the play session with momentary episodes of calm to regulate arousal. There is continuous physical movement around the infant's visual field and a change in facial expression in relation to infant affect. The rate and tempo of speech is increased and the parent displays variability in voice frequency and pitch. There are several animated utterances. The parent creates a lively interaction using all modes of stimulation.

4. As in rating 5, however on 1 or 2 occasions the parent may appear less energetic physically or less facially expressive. The rate of speech may drop and there may be a short pause in vocalisations with fewer behavioural and vocal animations. Or the father may be less efficient in using one aspect of stimulation

3. Generally the parent is lively. However on 3 or 4 occasions the parent may appear less energetic or facially communicative. Rate of speech is slower and the utterance of animated noise decreases. Or the parent is less efficient in using 2 aspects of stimulation

2. Occasionally the parent shows some excitement in engaging with the infant, but for most of the interaction the parent is contained and calm. Or the parent is less efficient in utilizing 3 aspects of stimulation.

1. Rarely is the parent excited or energetic during the interaction. There are a few quiet sounds and or minimal facial and emotional communication. The parent's tone of voice and pitch is low. The interaction is calm and contained.

Additional notes

Identifying smiles: *Occurrence*

- **Look at the infant** to identify a change in facial expression
- Code a smile only when you are certain that the infant changes facial expression.
- Ambiguous smiles should be recorded for each interaction and discussed case by case

Who initiates smiling between the dyad? *Lead-lag relations*

- Rewind a second backwards after the occurrence of a synchronous smile to check who initiates the smile. Check the infant and father's facial expression if the clarity permits

Tactile- Quality

- Touching the infant's clothes is not included unless it is practical touch
- *Inactive touch:* Episode ≥ 3 sec
- *Firm touch*: The parent uses the whole hand, and uses the *palms* of his hand to touch/hold/stroke the infant. Firm touch doesn't involve any movement of the infant's limbs
- *Stimulating touch*: Shaking the infant's limbs, or moving limbs back and forth or round and round. This touch involves *movement* light or more rigorous
- *Active touch*: Moving the infant's body position, lifting the infant up and off the mat and lifting the infant's lower body (legs) in the air. Continue to code for active touch as long as the infant is in the changed position
- If the parent is holding the infant's hand and using finger tips to touch the infant, code for the new type of touch or the latter one

Gross motor stimulation:

Rating physicality

5. Lifting the infant's upper body off the mat, pull infant up in a sitting position, change in body positioning
4= Moving the infant from side to side, holding legs up in the air and holding the lower body up
3= Hold and rough/rigorous movement (anything other than gentle falls here)
2= Hold and gentle/calm/tender movement of infant's limbs
1= Touch and hold toes and arms only

Destabilizing behaviours

1. **Identify the occurrence of the behaviour first**: defined as **sudden, unexpected, emotional-** verbal or a behavioural action
2. Check the infant's response: startle, surprise, arrest of motor or vocal activity

[Also check the infant's motor movement, which may come to a sudden stop]

Appendix 4B: Sample coding sheet

OXFORD FATHERS PROJECT
Coding summary sheet (Father floor-mat context)
Paternal-Physicality Affect Touch Scale (P-PATS)

Active Engagement

Vocal stimulation	*[Note frequency, duration]*
1. Increased pitch, rate and tempo of speech	
2. Variability in voice frequency and pitch	
3. Animated sounds	
4. Using speech to communicate to the infant	
5. Using speech in the context of a game	
Physical stimulation	
4. Physical orientation and movement around the infant	
5. Use of touch	
6. Game-playing using hands	
Emotional stimulation	
1. Varied facial expression	
2. Exchange of positive emotions through smiling	
Psychological stimulation	
3. Responding to the infant	
4. Talking about the infant more and self less	

Physicality in play- gross motor stimulation *[Note frequency]*

5. Change position
4. Move infant from side to side and or legs up in the air
3. Hold+ rough/ rigorous movement
2. Hold and gentle movement
1. Touch only

Tactile Stimulation

Type of touch *[Frequency]*	Duration of episode	Type of touch *[Frequency]*	Duration of episode	Infant response		
				Positive	Negative	Neutral
Inactive touch						
Light touch						
Type of touch *[Frequency]*	**Duration of episode**	**Type of touch** *[Frequency]*	**Duration of episode**			
Firm touch						
Stimulating touch						
Active touch						
Practical touch						

Excitatory Arousal

Nature & frequency [Inclusion criteria: Sudden, emotional, unpredicted, repetitive short sequences, or a single verbal/non-verbal action]		**Infants response** [Inclusion: Startle, surprise, sudden arrest of behaviour leading to either positive or negative affect and communication]	
Time	**Nature of activity**	**For 5 sec. before**	**For 5 sec. after**

Affective synchrony: (i) Occurrence, (ii) Lead-lag relations

Timing *Frequency count*	**F/I driven**	**Timing** *Frequency count*	**F/I driven**	**Timing** *Frequency count*	**F/I driven**	**Timing** *Frequency count*	**F/I driven**	**Timing** *Frequency count*

Appendix 4C: Procedure for coding individual sub-scales of the P-PATS

Tactile Stimulation

Touch was coded for the frequency (number of times) and the duration (total time) of each touch type. The percentage of time each touch occurred was then calculated by dividing the duration of time that a specific touch type was used by the duration of the total interaction time (i.e. 3-minutes). Tactile stimulation was restricted to directly touching the infant and indirect touching of the infant's clothes was not coded, unless the touch was functional for e.g. pulling up socks. We did not code for gestures within the infant's field of vision which some researchers include in their definition of touch (Stack & Arnold, 1998). Criteria for onset and offset times (points of transition) between each touch type are defined in the manual. Training of the additional coder emphasised not merely overall duration and frequency of touch but the timing of the change-over from one touch type to the next. This was recorded by stopping the video segment at the onset of the first occurrence and the last occurrence within each episode of touch. In the few rare instances that an episode of touch contained two styles for e.g. both firm and light styles, coders were instructed to code the current and salient touch style. This scale was coded based on touch and no other mode of interaction. Tapes were however not coded with the volume down.

Affective synchrony

Affective synchrony was coded for the occurrence of matched smiles and for the initiator of these matched emotional states. Our coding approach included synchrony as a match of phase rather than a match in the direction of change in behaviour. Video-tapes were watched in real time and a note was made of the change in facial expression in minutes and seconds. The coder then returned to examine the exact time of state change while the tape was rewound in slow motion. The positioning of the dyad within the video frame indicated that infant smiles were initially identified when the infant's muscles around the mouth, cheek and eyes were raised. The videotape was subsequently paused to identify the father's facial expression. Ambiguous father or infant smiles were discussed. The side profiles of both parent and infant on occasion compromised identification. Hence coders were instructed to record instances where clarity presided over a subjective identification. Only when smiles were well defined were they coded for occurrence of matched states. The procedure for detecting the initiator of matched states included, rewinding the recording 1-second prior to the identification of the matched state and viewing the facial muscles of both members of the dyad. Additionally a 'four step contingent exchange' sequence, facilitated examination of lead-lag relations. Such as when, father stimulated the infant, the infant responded to this stimulation by smiling, the father then responded to the infant's positive affect (matched state) followed by a pause, i.e. a resting phase of 3sec to regulate emotions. Similar structural units of play have been used in previous work by (Arco, 1983) and termed a 'bout'.

Finally we counted the frequency of matched states across the 3-minutes. Instances of simultaneous affect were noted but not used in the lead-lag analysis. We are aware that this method of coding may have its limitations. Retrospectively, we speculate that perhaps the use of computer software may have facilitated the identification of a split-second change in affective states.

Physicality in play and Active engagement

The above two variables were coded on a scale of 1-5. In coding for physicality in play, fathers whose play was restricted to touching and gently holding the infant were rated 1. Play which resulted in a change in infant physical positioning on the floor-mat was coded a 5. The presence of a single occurrence of physicality was coded rather than a frequency count of physical behaviours.

In coding for active engagement frequency counts were obtained for specific behaviours under the following modalities; emotional *(facial expression and behavioural excitement)*, vocal *(verbal and animated sounds)*, physical *(movement of and around the infant's visual field)* and psychological *(responsiveness, directing the infant's attention)*. Fathers who demonstrated increased availability and interest were rated a 5, whereas less engaged and active fathers were coded a 1. The final rating however was a reflection of a global aspect of interest and availability.

Excitatory arousal

The criteria for coding excitatory arousal included sudden, emotional, unpredictable; repetitive episodes or a single episode of paternal behaviour. Also included was the infant's response of surprise, startle and momentary arrest in activity. Coding involved, identifying paternal behaviours and re-viewing the segment to identify the infant's facial and behavioural reaction. A frequency of arousal episodes was coded for, across the three minute interaction.

Appendix 4D: Infant and father demographic characteristics

Characteristic	Paternal grouping		Total sample (n=34)
	Depressed (n=17)	Controls (n=17)	
Infant Gender			
Female	50 (12)	50 (12)	63.2
Male	50 (7)	50 (7)	36.8
Infant birth order			
1st Child	42.1 (8)	52.6 (10)	47.4
2nd Child	42.1 (8)	31.6 (6)	36.8
3rd Child	5.3 (1)	15.8 (3)	10.5
4th Child	10.5 (2)	.0 (0)	5.3
Father's age (years)	36.16 (6.04)	35.63 (4.87)	35.89 (5.42)
Father's education level			
GCSE's	5.3 (1)	15.8 (3)	10.5
A' levels/ school degrees	10.5 (2)	15.8 (3)	13.2
Diploma	31.6 (6)	10.5 (2)	21.1
Degree	31.6 (6)	36.8 (7)	34.2
Postgraduate	21.1 (4)	21.1 (4)	21.1
Marital Status			
Married	84.2 (16)	89.5 (17)	86.8
Living together	15.8 (3)	10.5 (17)	13.2
Ethnicity			
White	94.7 (18)	94.7 (18)	94.7
Black African	5.3 (1)	5.3 (1)	5.3
Language used with infant			
English	94.7 (18)	94.7 (18)	94.6
German	.0 (0)	5.3 (1)	2.6
Swahili	5.3 (1)	.0 (0)	2.6
Fathers employment status			
Full time	89.5 (17)	94.7 (18)	92.1
Part time	5.3 (1)	0 (0)	2.6
No job	5.3 (1)	5.3 (1)	5.3

Note: Data are expressed as percentages with frequencies in parenthesis, or means with standard deviations in parenthesis.

Appendix for chapter 5

Appendix 5A

Appendix 5A: Description of subscales of the P-CAMS

INFANT- FOCUSED SPEECH			
Category	**Sub-category**	**Description**	**Speech samples**
Internal state agency	**Cognitive state comments** [Psychological insight into the infant's thought processes, interest, imagination, memory intentions.]	Paternal comments relating to the infant's: *Mind, intellect, imagination, beliefs, wills, want's, desires, goals wishes and needs.*	*You 'want to' grab my fingers?* *You 'like' having your face stroked don't you?* *Thinking about your next move?*
	Emotional Processes [Psychological insight into the infant's emotional experience, expression, disposition (comments on a durable characteristic), feelings (subjective aspect) or emotional state (infant mood)] &	Paternal comments relating to the infants state and expression of: *Happiness, joy, sadness, enjoyment, excitements, grumpy, frightened, fretfulness, irritability etc.* References to feelings include those that refer to an emotional state.	*You're pretty happy, aren't you?* *You're not looking happy?* *Are you a grumpy baby?*
	Mirroring back infant's emotional expression [Paternal imitation of the infant's affective expression; this variable differs from emotional process as it involves *paternal responsiveness* and arose from the fathers response to the infant.]	The father's capacity to recognize and *respond* to the infant's emotional expression or change in emotional state. The variable is dependent on the infant's emotional expression.	
	Physiological state comments [A reference to the infant's bodily function.]	Paternal comments relating to the infants physiological state: *hunger, thirst, sleep, wakefulness, satisfaction etc.*	*Are you tired of playing these games?* *You're not still hungry are you?* *Are you a bit sniffly?*
External state agency	**Following the infant's direction of gaze and attention**	Paternal comments relating to the infant's attention/change in gaze: *paternal focus on an object (e.g. car-seat, clothing), body part or part of the environment (if the infant is looking around the room) on which the infant is focused, following a change in infant gaze and focus of interest through paternal discourse*	*You're looking at the colours?* *What can you see?* *Here are your toes? [Infant looking at toes]* *Are you looking at the camera?*

	Infant's physical movements & mirroring back infant's behaviour	Paternal discourse on the infant's *movement of limbs (particularly arms, hands)* as a cue to centre their own behaviour or attention. Additionally comments linked to the infant's intensions regarding motor activity or behavioural action	*Hey, look at you smiling?* *Are you kicking daddy?* *Are you moving your toes?*
	Vocalisations/Mouthing **&** **Mirroring back vocalisations/sounds**	Paternal speech or non-verbal utterances reflect recognition and imitation of the sounds made by the infant or the infant's intension to communicate through movement of the lips, tongue or mouth.	
Non-mentalizing comments	**Neutral**	Descriptive comments or questions directed at the infant	*There you are* *What have you been doing?*
	Positive	Praise, affectionate comments, terms of endearment	*You're brilliant* *Champion of the world* *You're gorgeous*
	Negative	Criticism, negative, disapproving comments at times expressing disappointment	*You getting all confusing* *Devious little bugger*
Attention orienting/ maintaining	**Greet /call infant**	Any greeting or calling of the infant is coded under this subcategory.	*Hello* *Hello Josh*
	Attention ability facilitation through: ▪ **song/game** ▪ **non-verbal sounds** [In coding this subcategory the infant is attentive and has maintained eye contact with the parent hence the verbal communication is *Infant- focused*]	Fathers ability to initiate, maintain the interest and attention of the infant through non-verbal sounds/songs and games. The mentalizing ability of the father enables the infant to enjoy the interaction and respond appropriately. The parent imitates non-verbal sounds emitted by the infant or encourages certain utterances used by their infant to convey a specific meaning during the communication.	*Rhymes* *Songs* *Playing games with the infant using hands* *Peek a boo games* *Clicking*

FATHER -FOCUSED SPEECH			
Self-oriented agency	**Self-referential/neutral-positive comments**	Paternal comments relating to their own experience with the infant and the context of play	*Here I am* *Daddy's watch* *Daddy doesn't play with you like this*
	Self-referential/ negative comments	Negative comments or speech directed towards parent.	*I'm not as good as mummy*
	Self-referential / Helplessness	Paternal self-appraisal: Negative comments specific to the parent's performance and difficulties experienced during play. Negative self-evaluation of failure, helpless and lack of control of the infant's behaviour (if distressed or avoidant)	*Mummy has left me with a grumpy baby* *Oh dear how does one play with you without toys*
	Self-referential /attention seeking demands ▪ **Verbal** ▪ **Non-Verbal sounds** [The verbal demands or non-verbal sounds are directed to an infant whose focus of attention is elsewhere, i.e. the parent and infant have not established eye-contact and the communication is *parent-focused*]	Paternal comments relate to the infant's compliance with parental expectations. The parent makes certain demands of the infant when his state doesn't permit communication or his attention system is not focused on the parent. This category differentiates between a father who is aware of the infant's wishes and focus as opposed to one who is not in tuned with the infant's experience but has certain expectations of infant behaviour.	*Are you going to smile for me?* *Look at my lip?* *See my fingers?* *Common, smile for daddy*
	Directive speech	Paternal comments instructing the infant to behave in a certain style in accordance to the parent's perception of a 'good infant' indicating control, discipline, low tolerance and acceptance of the infant's needs. An emphasis on compliance with parental expectations at the expense of the infant's wants and needs.	*Smile now* *Sit up* *Don't look there* *You are going to stay in there* *Pop your hands down*
	Infant-referential /	A statement reflecting paternal	*No, I don't think you*

	Corrections, criticisms and expression of disappointment	assertion of thoughts and ideas, leaving little space to include the infant's experience.	*are hungry* *No, you're not tired* *Oh, no don't grab those things around you* *Oh dear, no trying to come out*
EXPERIENTIAL REFERENCE			
Paternal appraisal process	**Situation-referential comments** [Appraisal of the current interaction task] ▪ Neutral ▪ Positive ▪ Negative	Paternal comments referring to the current situation	*This is different from your car seat* *I know it's weird in here* *All these props and people around today* *This is a nice seat* *We have no toys*
	Verbal indication of an implicit problem	Comments which refer to a problem not explicitly referred to by the parent but evident through narrative content. An indication of the parent experiencing difficulty with the infant and the current play context.	*You're coping really well* *It's not that bad*

OTHER-FOCUSED SPEECH	
Paternal comments don't refer to the current setting, i.e. the infant, father or current experience but are removed in time and context.	*It's what you do when we go out* *What's mummy doing?* *Are we going to go out into town?* *Is mummy putting your cards away?* *Should we go find mist, the cat in a minute?*

Appendices for chapter 6

Appendices- 6A-6E

Appendix 6A: Item loadings on the sub-scales of the CBCL/ ½- 5 (van Zeijl et al., 2006, Koot et al., 1997)

Oppositional (17 items)

1. Can't wait
2. Cries much
3. Demands must be met
4. Easily frustrated
5. Easily jealous
6. Feelings easily hurt
7. Gets into everything
8. Angry mood
9. Screams
10. Selfish
11. Stubborn
12. Moody
13. Sulks
14. Temper tantrums
15. Uncooperative
16. Wants attention
17. Whining

Aggressive (9 items)

1. Cruel to animals
2. Destroys own things
3. Destroys others
4. Disobedient
5. Fights
6. Hits
7. Hurts accidentally

8. Attacks people
9. Too loud

Overactive (5 items)

1. Can't concentrate
2. can't sit still
3. Constantly seeks help
4. Shifts activity
5. Refuses active games

Appendix 6B: Descriptive statistics: Mean and (*SD*) for maternal and paternal reports of the CBCL externalizing subscales

CBCL scales	Parent gender			
	Mother		**Father**	
Oppositional behaviour	8.13	(5.31)	8.59	(5.17)
Aggressive behaviour	1.56	(1.84)	1.74	(1.74)
Overactive behaviour	2.81	(2.00)	2.82	(1.83)
Total externalizing score	12.48	(7.68)	13.17	(7.43)

Note: Maternal and paternal ratings were not significantly different

Appendix 6C: Correlations between maternal and paternal ratings on child externalizing behaviours

	Oppositional behaviours-F	**Aggressive behaviours-F**	**Overactive behaviours-F**	**Externalizing score-F**
Oppositional behaviours-M	**.39 *(p=.000)***	**.21 *(p=.035)***	.06 *(p=.535)*	**.33 *(p=.001)***
Aggressive behaviours-M	.05 *(p=.632)*	**.20 *(p=.047)***	-.02 *(p=.814)*	.08 *(p=.464)*
Overactive behaviours-M	**.35 *(p=.000)***	**.20 *(p=.047)***	**.31 *(p=.002)***	**.37 *(p=.000)***
Externalizing score-M	**.37 *(p=.000)***	**.25 *(p=.014)***	.12 *(p=.243)*	**.34 *(p=.001)***

Note: M= Mother rated scale; F= Father rated scale; Significant correlations are in bold

Appendix 6D: Mean scores on externalizing behaviours for males and females

	Males (n= 42)		**Females (n= 56)**			
CBCL scores	Mean	*(SD)*	Mean	*(SD)*	*t*	*p-value*
Maternal ratings						
Oppositional behaviour	7.52	(4.71)	8.58	(5.72)	.97	.332
Aggressive behaviour	1.71	(2.23)	1.43	(1.50)	-.72	.476
Overactive behaviour	2.74	(1.71)	2.86	(2.21)	.30	.765
Total externalizing score	11.98	(7.41)	12.87	(7.92)	.57	.573
Paternal ratings						
Oppositional behaviour	8.13	(5.48)	8.95	(4.95)	.77	.442
Aggressive behaviour	1.87	(1.90)	1.64	(1.62)	-.64	.527
Overactive behaviour	3.06	(1.87)	2.64	(1.79)	-1.12	.266
Total externalizing score	13.05	(7.83)	13.25	(7.19)	.13	.901

Appendix 6E: Correlations between depressive symptoms (EPDS scores)[1] and externalizing behaviours according to child gender

EPDS	Oppositional behaviours	Aggressive behaviours	Overactive behaviours	Externalizing total score
Males *(n= 42)*				
Maternal CBCL ratings				
EPDS	.22 *(p= .169)*	.15 *(p= .360)*	.26 *(p= .097)*	.24 *(p= .124)*
Paternal CBCL ratings				
EPDS	**.35** *(p= .024)*	.06 *(p= .707)*	.27 *(p= .082)*	**.32** *(p= .037)*
Females *(n= 55)*				
Maternal CBCL ratings				
EPDS	.18 *(p= .190)*	.07 *(p= .622)*	.22 *(p= .114)*	.20 *(p= .137)*
Paternal CBCL ratings				
EPDS	.14 *(p= .298)*	.02 *(p=.893)*	.25 *(p= .063)*	.16 *(p= .237)*

Note: EPDS = Edinburgh Postnatal Depression Scale; [1] Paternal EPDS measured 7-weeks post-birth